lings continue as a major concern, additional attention must be directed to the impact that environment during growth and development of the mother plant may impart to the progeny. The biochemical and physiological bases for these phenomena are unknown. Pertinent knowledge may identify ways for changing the genetic cytoplasm or whole plant for improving uniformity and growth.

Uniform healthy plants are essential for efficient tobacco production. Research on improving plant production (controlled environment, disease and insect control, and optimal plant size for different dates of planting) is vital. Likewise, uniform growth and maturation (plant to plant, and possibly within-plant) is basic to the mechanization of production, harvesting, and curing operations.

Evidence indicates that environmental influences early in the growth of the plant may establish potentials for yield, quality, and uniformity of maturity. The effect of environmental influences on rate and uniformity of seed germination and rate and uniformity of seedling growth should be fruitful areas to investigate. The effects of environment above and below the soil level, on the growth and development of the crop on final yield, quality, and uniformity should be elucidated. Since there are many facets to gaining an understanding of the development of uniform transplants they should be studied by an interdisciplinary team. This team should include representatives from the following disciplines : physiology, genetics, soil science, crop science, plant pathology, entomology, engineering and economics. Transplants of uniform size can be moved mechanically from bed to field. Uniform field plants can be mechanically topped, treated for sucker control, and harvested.

The life cycle of the tobacco plant may be subjected to interruptions of growth under present cultural practices. A natural interruption of growth processes occurs when the plant is removed from a protected environment and transplanted. The inherent potential in the seed to resume growth is believed to develop during seed formation and maturation. Seed storage, however, may modify this. The inherent capacity of the transplant to resume growth in the field lies with the predisposition received by the transplant from the plant bed environment to initiate and form a new root system. The necessity to develop a new root system after transplanting could be bypassed by direct seeding.

The history of tobacco culture in most countries has followed a common pattern. New lands suitable for tobacco were in limited supply thus the practice of growing tobacco continuously on the same land gained favor. Yields were low compared to present day standards, but through the use of commercial fertilizers and skillful culture, growers produced reasonably satisfactory crops. The expansion of tobacco culture, its localization in certain areas, favored by soil and climate, and the practice of growing tobacco continuously in the same land favored the spread and build-up of destructive soil-borne diseases. The nematode diseases of tobacco provide an excellent case history. Certain species of the meadow nematode and the stunt nematode live on native weeds, grasses, and shrubs. Under natural conditions these pests are a part of the native microflora of the soil, and their populations are held in check by limited food supply and other innate forces. When a large supply of suitable food is furnished by a susceptible crop of tobacco, some of the factors that had originally kept these organisms in check are removed and dramatic changes take place. When destructive soil-borne disease causing organisms are well established in tobacco, two basic methods for control may be used. One method is to reduce the harmful effects of disease organisms by developing crops that resist or endure attack. Secondly, means can be explored for controlling the pathogen populations by reducing them to noninjurious levels. Cases can be cited where resistant varieties have reduced harmful effects of diseases to such an insignificant level that production could be maintained on a profitable scale. Resistance alone has not been sufficient. The disease situation in tobacco is extremely complex because of the large number of diseases involved and magnifies the difficulty of developing acceptable varieties possessing multiple resistance. The plasticity of disease organisms to the influence of selection pressures imposed by changes in varieties and other management practices reduces the prospect of producing new varieties with lasting utility. Disease causing organisms possess similar mechanisms for genetic variance as those of higher plants and animals. Even though the development of disease resistant varieties may not provide a complete or permanent solution to tobacco disease problems, it will continue to play a key role.

Two principal means of controlling the inoculum potential of the pathogen are by 1. the use of chemicals or 2. biological control. Soil fumigants and multi-purpose chemicals have

become a standard cultural practice in some areas. The use of these chemicals has been effective and profitable. The success of current disease control practices illustrates the degree to which it has been possible to provide a suitable production environment. Crop rotations have played significant roles in the control or reduction of populations of plant pathogens. Biological and ecological control measures, when developed and properly applied, may produce long lasting or even permanent benefits.

Disease control is a continuous process. Control methods must constantly improve, pathogens must be observed for changes which render control practices ineffective, new diseases must be identified, and disease control practices must be integrated with other production practices. Soft rot, both bacterial and fungal, in curing barns, is becoming more important. This condition may be related to changes in harvesting and curing operations. Mechanization in some areas is forcing more growers into continuous tobacco culture, thus negating beneficial disease control obtained from rotation.

It is anticipated that the struggle with tobacco insect pests will continue as long as the human race endures. This can be expected since man and certain insect species compete for the same things. Tobacco is subject to insect attacks from the time the seed is planted until the crop is safely harvested. The cured leaf and/or manufactured tobacco products are subjected to further insect attacks. The tobacco moth, for example, is assuming major importance. Tobacco insect populations are variable with respect to time, environment, and range from the beneficial ones to those which are destructive. Certain control practices may destroy the destructive insects, enhance the beneficial insect populations or ravage them, thus creating an ecological and biological imbalance.

Control of several pests of tobacco is essential for the production of high quality leaf. Scientists have developed three primary methods for controlling tobacco diseases and insects – 1. crop rotation, 2. resistant varieties, and 3. the use of chemicals. In many instances it is necessary to use a combination of all methods in producing a crop.

Agricultural chemicals are important and oftentimes the only feasible means for controlling tobacco pests. The concern for pesticide residues in and on tobacco leaf and in tobacco smoke is becoming more prevalent. Provisions must be made to provide immediate answers and solutions to queries through a well conceived and comprehensive world-wide cooperative research effort. For most pesticides (insecticides, herbicides, fungicides, nematicides, and growth regulators) applied to tobacco, losses that occur during curing, storage and processing must be determined. An understanding of rates and pathways of degradation and the factors influencing losses is essential in developing techniques to reduce pesticide residues. High temperatures in the burning zone of cigarettes produce drastic (qualitative and quantitative) chemical alterations of tobacco constituents. Although research on the pyrolysis of certain agricultural chemicals has been conducted, little is known about pyrolytic products of pesticides used on tobacco plants. A minimal acceptable research program for evaluating the fate of pesticide residues on tobacco should include the following general research areas : 1. pesticide residues on green leaf and cigarettes, 2. metabolic changes of pesticides in the growing plant, 3. loss of pesticides during curing, storage and manufacture, and 4. pyrolysis of pesticides during smoking. In attaining long range research objectives of understanding and managing tobacco insects and their effects on 1. growing plants, 2. cured leaf, 3. manufactured products, and 4. consumer acceptance, an understanding of both the host and the insect is essential. Even more important is a knowledge of how to modify all major factors to create a desirable balance among host, insect, and management. Control of weeds in tobacco is as important as the control of disease and insect pests. The shrinking labor supply as well as high labor costs places extreme economic emphasis on research designed to control weeds and grass efficiently and effectively. Chemical compatibility studies must be expanded to determine the effects on the tobacco plant of simultaneous application of several pesticides.

New materials, handling and curing procedures offer possibilities for greatly increasing harvesting and processing capability with minimal labor requirements. Concepts of handling and curing sized strips, pneumatic conveying, automatic filling of curing containers, etc. merit further testing, development and evaluation. Integration of new materials handling procedures into harvester design should be made assuming favorable economic projections and continued success of curing cutstripped tobacco. Further development of the materials handling and curing system should take into account 1. capacity, 2. curability as related to processing parameters, 3. process control including post-curing conditioning, 4. market prepara-

tion, and 5. economic analyses of the complete harvest-curing system.

The most profitable combination of production enterprises given the objective function to be maximized and the resources available for use during a specific time period should be determined. An evaluation of the potential impact of alternative policies involving all countries would provide a basis for decision making by producers, resource owners, governmental agencies, and related interests.

Tobacco substitutes and health related aspects of tobacco consumption may present major threats to the tobacco economy. Although such research may not be considered the responsibility of plant researchers, investigations should be designed pertinent to the safety and comfort of consumers. This implies the necessity for the continuation or expansion of studies on 1. the effects of leaf microflora on tobacco quality and on consumer health, 2. pesticide residue analyses, 3. biophysics of tobacco processing, and 4. tobacco leaf evaluation.

Leaf chemistry and physical properties can be modified within wide limits in plants to achieve marked changes in cigarette smoke composition and "tar" delivery.

Public research agencies involved with tobacco, the plant, in general, have their greatest expertise of research personnel involved in the development of 1. plant genotypes; 2. production practices, and 3. curing systems which result in tobaccos with relatively precise chemical and physical properties.

Preliminary studies indicate that cigarettes derived from currently grown U. S. flue-cured varieties differ significantly in « tar » production. Genetic analyses of one flue-cured tobacco population for cigarette measurements and smoke constituents demonstrated that « tar » output for cigarettes is heritable and that expected changes upon selection would be about equal to that for any other quantitatively inherited character.

Each year our tobacco researchers produce experimental tobaccos grown and cured under known cultural and environmental conditions. These tobaccos are usually described agronomically, analyzed for a few chemical constituents that traditionally influence manufacturer acceptability, and then discarded. Cured leaf samples from some field trials would be ideally suited for further chemical and smoke analyses and thus provide a basis to increase our knowledge of the effect of varieties, production, management, and curing systems on smoke constituents. We would welcome an opportunity to make these samples available to research groups interested in conducting further evaluation.

This presentation could have been devoted to basking in the romance of successes and accomplishments pertinent to various segments of the tobacco economy during the past 484 years. Tributes could have been paid to numerous scientists whose efforts, dedication and devotion advanced tobacco – the plant. We must be ever mindful that we are constantly confronted with *demands* to provide solutions to complex, technical, economic and social problems. We have been and are fortunate to have *assets* of imaginative scientists, a creative environment and certain physical resources. *Progress* is apparent as witnessed by an expansion of technology and synthesis of new knowledge into practice. This has been possible because of *coordination*, i.e. cooperation with public and private agencies. The finale may be used as a stage from which projections are issued. Among our responsibilities and obligations is that of attempting to peer with precision into the future – thus it is in this spirit that the following comments are offered :

1. World tobacco production will continue and supply an abundance of cured leaf to meet world demands but it will do so with rising costs and increasing pressures on land, energy and environmental resources.
2. Improved tobacco varieties and cultural practices assuring desirable agronomic and quality characteristics will be developed.
3. Appropriate and cooperative research and technological developments must be pursued on an international level including the role and understanding of (1) integrated management, (2) the substitution of capital for labor, energy, etc., (3) understanding the role and significance of the plant to the manufactured product, (4) assessment of effect of science and technology on acceptance, and (5) capacity of the tobacco plant to synthesize, transport and accumulate dry matter.
4. Tobacco production capacities of some countries will become inadequate to meet domestic demands.
5. The relative cost of tobacco and tobacco products is likely to increase more rapidly than the cost of staple sources of food.
6. The marketplace must reflect an increased value of tobacco with improved quality if farmers are to be pursuaded to produce it.
7. The increasing cost of producing tobacco may eventually encourage the use of un-

conventional techniques not now in commercial practice including the development of reduced total particulate matter varieties, low nicotine varieties, direct field seeding, cross flow modular curing systems, cut strip curing, and close grown tobacco.

8. Unmanufactured and manufactured tobacco demands of effluent industrial countries will continue to increase and will exert greater competition on tobacco resource markets.

As we reflect on the past, use the present, and step forward into the future, may we always remember that the most important decision we ever make is when we employ a man or woman to dedicate their talents to gaining new knowledge of the tobacco plant. Individuals charged with administrative responsibilities must refrain from prescribing the specific course scientific investigations should follow but should rather direct their attention to the recognition of the capabilities of the scientists they employ and provide for them encouragement, resources and a creative environment. The future for tobacco, therefore, is entirely dependent upon the minds, body, soul and spirit of those who seek solutions of interest and value to all segments of the tobacco economy. I challenge you to select your associates and/or employees with care, wisdom, knowledge, patience, discernment and faithfulness to assure a better understanding of « tobacco – the plant »

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Recent Changes in Tobacco Products and their Acceptance by the Consumer

Changements Récents dans les Produits du Tabac et leur Acceptation par le Consommateur

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SUMMARY

For the smoker tobacco quality rests upon numerous beneficial effects which he derives from smoking. Tobacco science was, however, greatly challenged when these well known benefits were questioned by a host of health warnings against the use of tobacco.

The scientists working in our field had to face conflicting data. They were left without any advice about practical measures and were constantly pressed for immediate action. In this situation most of them set out to introduce gradual changes of smoking products in order to reduce the dosage to which smokers are exposed.

In the course of some twenty years the smokers did not only accept the new products but they reinforced the trend by changing their individual smoking habits. While cigarettes delivered less and less condensate the unsmoked cigarette butts became longer and longer. Both tobacco science and smokers' attitudes have thus resulted in substantial changes the significance of which is not well understood.

In spite of an increase in per capital consumption of cigarettes, condensate and nicotine have decreased by approximately 50 % and all chemicals belonging to the particulate phase have been reduced correspondingly. Furthermore, modern filters are selectively removing a number of vapor phase constituents such as volatile phenols. Finally residues from insecticides like arsenicals, DDT, endrin and dieldrin have essentially disappeared from tobacco smoke.

The trend towards new tobacco products still continues. The quantitative and qualitative changes achieved will be discussed in terms of dose and effect.

RÉSUMÉ

Pour le fumeur, la qualité du tabac repose sur les effets bénéfiques qu'il en retire.

La science du tabac s'est trouvée confrontée à un défi important lorsque ces bienfaits, bien connus ont été remis en question par une multitude d'alertes sanitaires contre l'usage du tabac.

Les chercheurs dans notre domaine ont dû affronter un dilemme : ils étaient laissés sans conseil sur les mesures pratiques à prendre et pressés constamment d'agir sans délai. Dans cette situation, la plupart d'entre eux commencèrent à introduire des changements progressifs dans les produits du tabac afin de réduire la dose à laquelle les fumeurs étaient exposés.

Au cours d'une vingtaine d'années les fumeurs ont non seulement accepté les nouveaux produits mais ont renforcé la tendance en modifiant leurs habitudes personnelles de fumeur. Tandis que les cigarettes produisaient un condensat de plus en plus réduit, les mégots, sont devenus de plus en plus longs. La science du tabac et cette attitude ont ainsi marqué des changements considérables, dont la portée est la plupart du temps négligée.

Malgré l'augmentation de la consommation de cigarettes par tête, le condensat et la nicotine ont été réduits d'environ 50 % et tous les produits chimiques appartenant à la phase particulaire ont été réduits en conséquence. De plus, les filtres modernes retirent de manière sélective un certain nombre de composants de la phase vapeur tels que les phénols volatils, enfin les résidus d'insecticides, tels

que produits à base d'arsenic, DDT, endrine et dieldrine, ont pratiquement disparu de la fumée de tabac. La tendance vers de nouveaux produits de tabac ne cesse de se confirmer. Les modifications quantitatives et qualitatives obtenues seront évoquées en termes de dose et d'effet.

INTRODUCTION

With a slight change of the original text as found in the older literature the attempt may be made to define quality as follows : "The qualities of tobacco and smoke are the attributes grounded on the sensations which the presence of that particular tobacco smoke to our organs excites in our minds".

The original text (1) deals with « the quality of a body » and the presence of that particular « body » but otherwise this definition given by J. S. MILL (1806-1873) may be quite helpful because of the following points :

– Indicators of quality are the sensations excited in our minds

– These sensations are provoked by the presence of tobacco smoke to our organs

Quality is, therefore, highly subjective, centers around experience and judgement of the smoker and is well covered by

– organoleptic properties of tobacco and

– beneficial effects of smoking.

From the highly subjective nature of this definition does, however, follow that we have to weigh

– positive organoleptic properties against those creating negative sensations and

– beneficial effects against undesirable ones.

Examining this catalogue of terms, we find that people have different ideas about quality of tobacco, about positive or negative organoleptic properties and about beneficial or undesirable effects of smoking.

For the smoker, tobacco brings pleasure and satisfaction. He enjoys smoking because of its well known beneficial effects. During the past twenty years, however, a number of authorities, both medical and governmental have started to point at so many ill effects of smoking and certain public agencies have so furiously joined in a merciless battle against smoking that emotions have widely replaced scientific judgement and any sense of proportion was definitely lost.

The smoker was left entirely alone. For him "each single cigarette continued to be a most gratifying experience" but he had to listen to official statements claiming that "even one single cigarette might cause severe illness" and that no safe level of smoking existed (2).

This conflict between a most human desire for the pleasure of smoking and the storm against tobacco seems to have induced the hosts of the first CORESTA Congress to state that the congress "aimed at the reinstating man in the centerpoint of all aspirations, amid a world in which science and technics threaten to make him less and less human" (3).

With this basic philosophy tobacco science promoted new concepts of quality. Today, only twenty years later, the world of tobacco has totally changed.

While some are still hanging on to their idea of the ill effects of even one cigarette (2), tobacco science has reestablished proper judgement. Nowadays, governmental research institutes together with scientists from our industry are trying to define a « usability index » of tobacco products (4), and the smoker, no longer afraid of ill effects from one single cigarette is developing new confidence.

The smoker's happy return to his world of personal pleasure does, however, still find a major obstacle in the health warning printed on cigarette packs. The smoker cannot judge whether these warnings are justified but they do certainly excite negative sensations in his mind. For him these warnings based on results from research in epidemiology, chemistry, and bioassay are negative factors of quality.

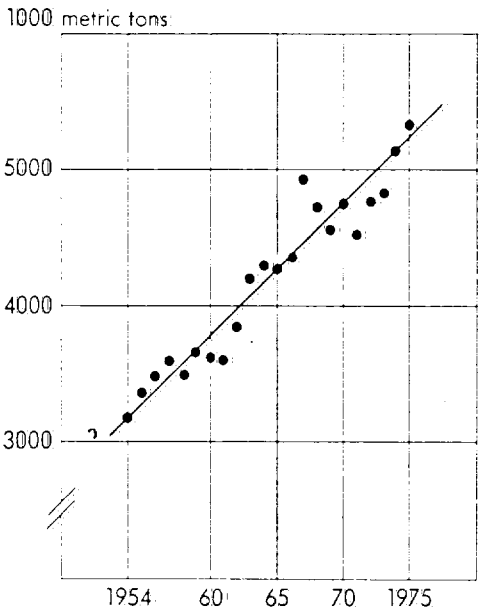
As the smoker was to be "reinstated in the centerpoint of all aspirations", tobacco science has closely followed the discussions in these fields and has, in fact, most positively contributed to the solution of many problems.

During the past twenty years, tobacco products have drastically been changed and the new products have been well accepted by the smoker. Regarding tobacco quality as judged by the smoker, it is certainly worthwhile to summarize the relevance of these changes and to concentrate on some attributes at which the smoker and the public exposed to continuous official announcements may take a dim view.

The demand for tobacco as revealed by the increase in tobacco production (5, 6, 7), in cigarette output, and in the sales of cigarettes per capita has steadily increased during the past twenty years and rates of national sales have widely been used for the calculation of all kinds of correlations, including those on cigarette

smoking and health problems. Especially in this field they are, however, almost completely meaningless.

Figure 1
World Tobacco Production 1954–1975 (in 1000 metric tons)



As shown in the following analysis*, the only significant data are those of smoke delivery per smoker and these have greatly been influenced by the gradual introduction of modern smoking products and in parallel, by important changes in the smoking habits of the consumer.

MANUFACTURE OF MODERN CIGARETTES

1. Reduction of condensate and nicotine

Guided by growing knowledge accumulated by tobacco science and assisted by the rapid development of tobacco technology, the manufacturers have achieved considerable changes in the make-up of cigarettes which at first approximation can be seen from the drastic decrease of condensate and nicotine per cigarette.

Condensate and nicotine per cigarette are listed covering a period up to twenty years. The trends are shown in figures 2-4. Data are from the United States (8, 9), Germany** (10, 11) and Switzerland (12).

*The analysis has to be restricted to cigarettes and to concentrate on a few countries.
**Federal Republic of Germany

TABLE 1

Sales weighted average deliveries of condensate and nicotine (mg/cigarette)

UNITED STATES		
Year	Dry condensate*	Nicotine
1955	39.7	2.69
1960	28.6	1.60
1965	24.2	1.40
1970	21.3	1.40
1975	19.2	1.18

GERMANY			
Year	Condensate		Nicotine
	Total	Dry	
1961	28.3		1.44
1966	22.7	20.7	1.18
1970	18.2	17.4	1.00
1975	15.2**	14.1	0.66

SWITZERLAND		
Year	Dry condensate	Nicotine
1970	24.3	1.38
1975	15.6	0.95

* "FTC-tar" with nicotine added
** Estimate

1) Because of differences in machine smoking, values must not be compared between countries.
2) Total condensate includes water, dry condensate does not. FTC-tar is dry condensate without nicotine as defined by the Federal Trade Commission of the United States.

Figure 2
USA
Sales weighted average deliveries of total condensate (dry) and nicotine per cigarette 1954–1975

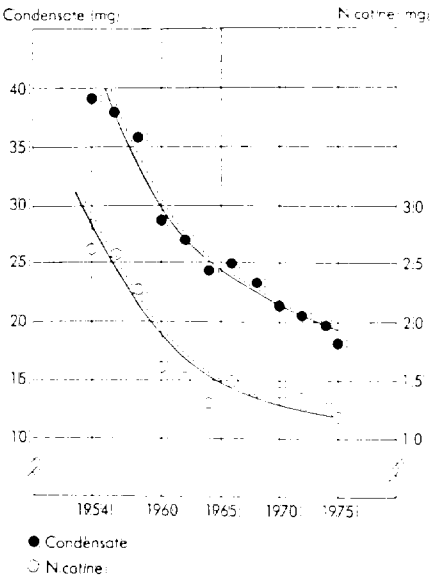


Figure 3
Germany
Sales weighted average deliveries of total condensate and nicotine per cigarette 1961–1975

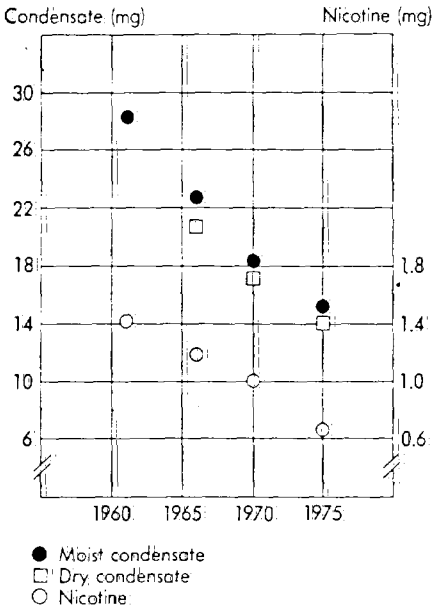
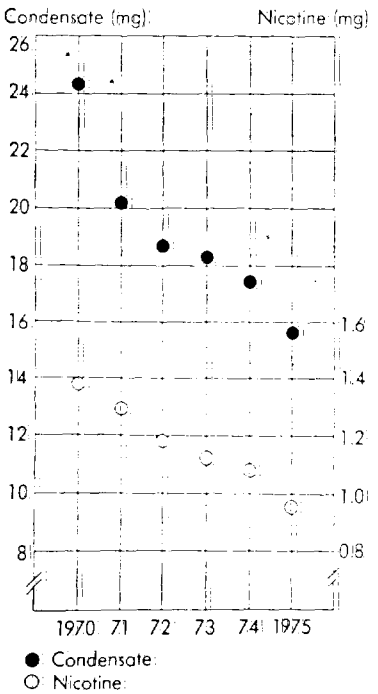


Figure 4
Switzerland
Sales weighted average deliveries of total condensate (dry) and nicotine per cigarette 1970–1975



Differences in the analytical procedures do not justify direct comparison between the three selected countries but the examples are well suited to demonstrate an important trend which is almost alike in all three sets of data and which can be observed in many other countries as well (13; 14).

2. Methods applied

To achieve this reduction the manufacturers have combined careful tobacco selection with several important changes in the processing of tobacco and in the manufacture of cigarettes. The latter are summarized in table 2.

TABLE 2

Changing technology in the processing of tobacco and in the manufacture of cigarettes

PROCESSING OF TOBACCO LEAF	
Extraction	Expansion
Additives	Stems
Reconstituted tobacco	

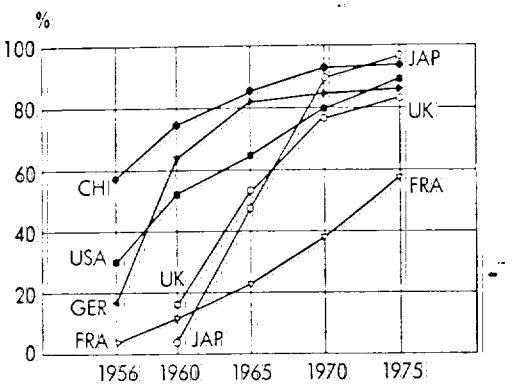
MANUFACTURE OF CIGARETTES	
Dimension	Density
Air permeability of cigarette paper:	
Porosity	Perforation
Filters:	
Cellulose	Additives
Cellulose acetate	Ventilation
Activated charcoal and other adsorbents	
Tobacco substitutes	

Changes in these parameters and all conceivable combinations of such changes are now widely used. Their significance will be discussed later. The most important factor, however, was the comprehensive introduction of cigarette filters.

3. Filter cigarettes

Some examples for the increasing use of filter cigarettes and the considerable differences in percentages and trends are illustrated in figure 5 (15).

Figure 5
Percentage of filter cigarettes in selected countries 1956–1975



MODERN CIGARETTES – ACCEPTANCE OR COMPENSATION

The term compensation is used for changes in the individual smoking habit with the objective of obtaining more smoke from cigarettes that deliver less condensate and nicotine.

Some researchers have postulated that habitual smokers have developed the need for a constant intake of nicotine which they will always try to satisfy. When smoking cigarettes low in nicotine and condensate they are, therefore, expected to increase either the number of cigarettes, the puff volume or the frequency of puffs (16, 17). They are said to inhale more deeply and to discard shorter cigarette butts.

In contrast, smokers changing to high-nicotine cigarettes are expected to reduce their daily consumption (18, 19).

None of these postulates appear in fact valid as will be shown in the next sections on the length of discarded cigarette butts, on some laboratory experiments with test smokers and on smoking habits of total populations.

1. Length of discarded cigarette butts

A trend toward longer cigarette butts has obviously started some 30 years ago and it has continued for the whole period of time during which smoke per cigarette was on the decrease. Published data (20-33) on the length of cigarette butts are summarized in figure 6.

The significance of such changes has been discussed as early as 1957-1959 (34, 28, 35) and it is almost twenty years ago that LINDSEY (36) presented the following figure 7 to give a general idea of the negative correlation between butt length and condensate yield.

Figure 6
Length of discarded cigarette butts (mm) 1932–1974

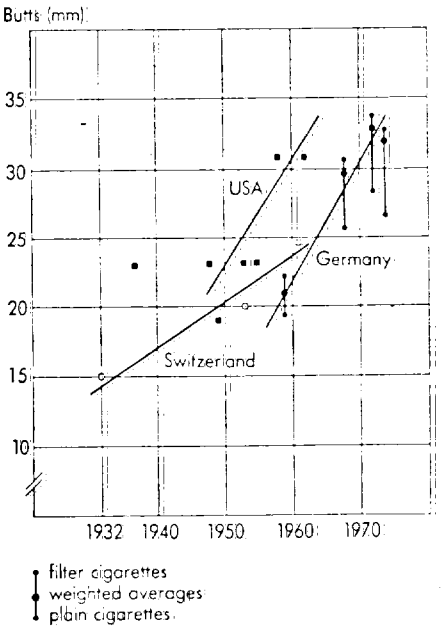
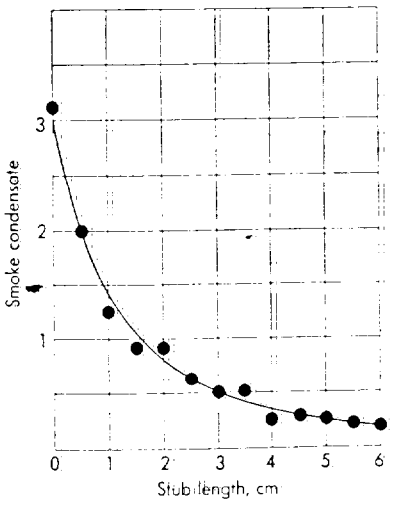


Figure 7
Relation between length of cigarette butts and yield of condensate (Lindsey, 1959)



Condensable matter in mainstream cigarette smoke measured for various stub lengths.
Amount from 1.5 cm stub = 1.

By leaving longer and longer cigarette butts, the smoker has greatly enforced the long term trend towards decreasing yields of condensate and nicotine.
Interestingly, younger smokers seem to discard longer butts than the older ones (37).

TABLE 3

Length of cigarette butts discarded by Swiss smokers

Butt length by age groups (1963)	
Age (years)	Butts (mm)
15 – 20	25.3
31 – 40	22.6
51 and more	20.5

2. Pretreatment of smokers with nicotine

a) If nicotine was applied orally in an almost toxic dose, smokers consumed twelve instead of thirteen cigarettes (38).
b) Nicotine injected intravenously and not exceeding the usual dose of a heavy smoker, had no influence on cigarette consumption. Only a dose of nicotine equal to that from 40-110 cigarettes per day resulted in a slight decrease of cigarettes smoked (39).
c) If test smokers were pretreated with cigarettes or with chewing gums containing different doses of nicotine, the latent period before smoking the next cigarette was shortened by low nicotine cigarettes (0.3 mg) but not by low nicotine gums.
The authors state that the time for which the cigarette is glowing while being puffed is the most sensitive index of cigarette consumption. This index was influenced by different nicotine in gums but not by differences in nicotine yields of cigarettes (40).

3. Test smoking of lighter or stronger cigarettes

a) No compensation
According to most investigators (41, 42, 43, 44), temporary changes of test smokers to « lighter » cigarettes resulted in a decreased intake of nicotine, condensate and carbon monoxide. In a recent experiment covering twenty months of observation, FRIEDMAN (45) studied the influence of replacing 30 percent of the tobacco of a cigarette by NSM* tobacco substitute, which resulted in a proportional drop of the nicotine yield. The authors evaluated observations from 160 test smokers but they were not able to observe any phenomena that would point to compensation.

b) Open questions and contradictions
Experiments performed by GUILLERM (46) and RUSSELL (19, 47-50) are often quoted in support of the hypothesis that smokers will always try to satisfy a constant personal need of nicotine.
GUILLERM asked eighty heavy smokers to switch from their usual brand to a newly developed « lighter » cigarette. After 35 days, cigarettes smoked per day, levels of COHb and some other parameters were determined.
In his main experiment, RUSSELL tested ten inhaling smokers during four days each in two consecutive weeks. They smoked their usual brand for one day. Afterwards five had to switch to « light », five others to « strong » cigarettes. The time of experiment was five hours per day.

Number of cigarettes smoked
The results of both experiments are summarized in the following tables:

TABLES 4a–4d

Smoking tests performed by R. GUILLERM and M.A.H. RUSSELL with different types of cigarettes

TABLE 4a

The test cigarette

Yield per cigarette (mg)			
	Light	Usual	Strong
	GUILLERM		
Condensate	12.4	28.2	
Nicotine	0.7	1.7	
Carbon monoxide	11.4	17.2	
	RUSSELL		
Condensate	4.0	*	38.2
Nicotine	0.14	1.3	3.2
Carbon monoxide	5.0	*	17.0

* No data available

*NSM = New Smoking Material

TABLE 4b

Changes in consumption

	Cigarettes smoked		
	Light	Usual	Strong
GUILLERM (1)	34	32	
RUSSELL (2)	12.5	10.6	6.7

(1) per day (2) within five hours

TABLE 4c

Delivery from all cigarettes smoked (mg)

Type of cigarettes			
	Light	Usual	Strong
	GUILLERM		
Condensate	422	902	
Nicotine	24	54	
Carbon monoxide	388	550	
	RUSSELL		
Condensate	50	*	256
Nicotine	1.7	13.8	21.4
Carbon monoxide	62	*	114

* No data available

TABLE 4d

Reduction of yield per cigarette and of delivery from all cigarettes smoked

Reduction (%)		
	Of yield per cigarette	Of delivery from all cigarettes
	GUILLERM	
Condensate	−56	−53
Nicotine	−59	−56
Carbon monoxide	−34	−30
	RUSSELL	
Nicotine	−89	−88

Switching from the usual to the lighter cigarette

Both the smokers of GUILLERM and of RUSSELL smoked two more cigarettes, but the total delivery per smoker of nicotine was reduced in almost exactly the same way as the yield of the cigarettes. As shown in the data of GUILLERM, the same is true for condensate and carbon monoxide.

The lower yield of « lighter » cigarettes is, therefore, *not* compensated by an increase in cigarette consumption.

Switching from the usual to the stronger cigarette

In RUSSELL's experiment four cigarettes less were smoked of the « stronger » cigarette, the total delivery of nicotine was, however, still 55 % higher. It seems safe to assume that the total delivery of condensate will have increased in the same order of magnitude.

The theory that reduced consumption of high nicotine cigarettes will reduce the total delivery of condensate to the smoker is, therefore, not supported by this experiment.

In a recent publication GOLDFARB (51) concluded that smokers would compensate for low nicotine yields per cigarette, but this is not shown in his experiments. In the first experiment switching to cigarettes high in nicotine resulted in an increase in cigarettes consumed, switching to low nicotine cigarettes gave the same result. Both differences were not significant.

The second experiment can be summarized as follows :

TABLE 5

Smoking tests with habitual cigarettes and with three types of experimental cigarettes (GOLDFARB, 1976)

Type of cigarettes	Nicotine per cigarette (mg)	Cigarettes consumed	
		Number	Total yield of nicotine (mg)
Usual	1.17	30.9	36.2
Experimental			
Low	0.39	29.9	11.7
Medium	0.77	29.0	22.3
High	1.36	26.5	36.0

Smokers consumed less of *all* experimental cigarettes, they did *not* increase the number of cigarettes smoked if switching to « low » or « medium » experimental cigarettes, both considerably lower in nicotine than their usual brand.

In relation to the « medium » experimental

cigarette
– one cigarette was smoked more of the low nicotine type, but the total nicotine yield was 50 % less
– three cigarettes were smoked less of the high nicotine cigarette, but the total nicotine yield was 60 % higher.
Remains to be seen whether compensation is achieved by the way of *how* a cigarette is smoked.

Carbon monoxide hemoglobin
In the experiment performed by GUILLERM higher levels of COHb were observed after smoking the lighter cigarettes.

TABLE 6

Carbon monoxide hemoglobin determined after smoking different types of cigarettes (GUILLERM, 1974)

Cigarettes		CO (ml/cig.)	COHb (%)
Type	Daily consumption		
Light	34	11.4	7.4
Usual	32	17.2	5.8

The finding is unexpected and often quoted as demonstrating compensation by forced inhalation.
In contrast, RUSSELL (47) reported that the increase in COHb after test smoking of extra-mild cigarettes was much smaller than after smoking of non-mild cigarettes.
In the experiment described above, the same author observed an increase of COHb if the habitual cigarettes were smoked. COHb decreased, however, after switching either to the « lighter » or to the « stronger » cigarettes.
Forced inhalation or some other change in the way of how a cigarette is smoked cannot explain these contradictions, but the results may well indicate that the formation of COHb depends more upon a great number of other influences than upon the intake of tobacco smoke.

Nicotine in the blood
Because of rapid metabolic transformation reliable data are difficult to obtain. RUSSELL (49) found a slight increase in smokers of their habitual cigarettes and a sharp decline after switching to low-nicotine cigarettes. On the other hand, after switching to a high-nicotine brand the nicotine level in the blood increased in five test persons and decreased in the five others.
These results do not point at forced inhalation or a similar mechanism by which the intake of nicotine would be increased.

4. *Average smoking habits of total populations*

a) The increase in cigarettes per capita started much earlier than the decrease of condensate per cigarette. The increase in sales is, therefore, not caused by the introduction of « lighter » cigarettes.
b) During the years in which condensate and nicotine per cigarette were drastically reduced, the smoker has not only accepted these changes but from the total market he has preferred
– the filter cigarettes
– the cigarettes with low yields of condensate and nicotine.
If the smoker would have tried to compensate for low condensate and nicotine, he had preferred plain cigarettes and the « strong » ones. Filter cigarettes and low condensate/low nicotine cigarettes would not have been successful on the market.
c) During the time of gradual decrease in condensate and nicotine per cigarette the smokers have not compensated by smoking to shorter butts. On the contrary, by smoking to longer butts they have taken less and less smoke from their cigarettes and they have enforced the downward trend considerably.
d) In the long run a compensation by an increase of consumption cannot be observed. On the contrary, after switching to filter cigarettes, smokers did not increase their daily consumption (52).
e) Cigarettes low in condensate and in nicotine do not induce the smoker to inhale more (37) as has been demonstrated by WALTZ in 1963.
f) Filter cigarettes were smoked with smaller puff volumes than plain cigarettes (22).

5. *Comment*

Before engaging in the development of modern smoking products, tobacco science had to find out whether lighter cigarettes would be accepted without compensation. Reliable results were published almost twenty years ago (53, 34, 54, 55). In 1961 WALTZ (22) observed the smoking pattern of Swiss smokers and performed a great number of experiments on the influence of the individual parameters of smoking (56) like

butt length
puff frequency
puff duration
interval between puffs
and puff volume.

From their analysis of the smoker's reaction to lighter cigarettes they concluded that such products would be accepted without compensation. This prediction has fully been confirmed by the attitudes of the smokers later on observed in total populations.

Compared with these large scale observations, recent experiments with small groups of test smokers do not carry much weight and the results are rather controversial. For the following reasons they fall short of presenting conclusive evidence :

– They included only very few test smokers who were by no means representative for the smoking population.

– The smokers were mostly asked for immediate changes to strange products. In such a situation neither a cigarette with 0.14 mg nicotine and 4 mg of condensate is accepted nor such an extreme product with 3.2 mg nicotine and 38 mg condensate.

Such cigarettes are not found in the viable segment of the cigarette market and sudden changes of that type have nothing to do with the gradual introduction of modern products over a period of many years.

Some type of compensation in an experimental set up may well be expected, if mg nicotine per cigarette differs as widely as

1.7 : 0.7

or 3.2 : 0.14

and if the changes are performed in a rather short time (GUILLERM, RUSSELL).

Changes between

1.4 mg and 1.0 mg

of nicotine and observation during twenty months did, however, not reveal any sign of compensation (FREEDMAN). In the total population of smokers the decrease of nicotine from 1.4 mg to 1.0 mg has been achieved in the course of 8 - 9 years (Germany, table 1). Such gradual changes are well accepted and they demonstrate quite convincingly that laboratory experiments may easily be misleading. Russell's proposal to reduce only condensate per cigarette but to maintain nicotine at a medium level (57) is based on the assumption that smokers would suffer from nicotine deprivation, if nicotine per cigarette would be reduced below an average yield of 1.0 - 1.3 mg per cigarette. As nicotine deprivation has as yet not been noticed, tobacco science should continue to observe the acceptance of new products on the market and should design the future products accordingly.

DECREASE OF SMOKE PER SMOKER

1. Particulate phase

Condensate and nicotine

In the United States percentages of smokers in the total population have been published for five individual years between 1955 and 1970. Using the sales weighted averages per cigarette, the annual delivery of smoke condensate and nicotine per smoker can, therefore, be calculated.

TABLE 7

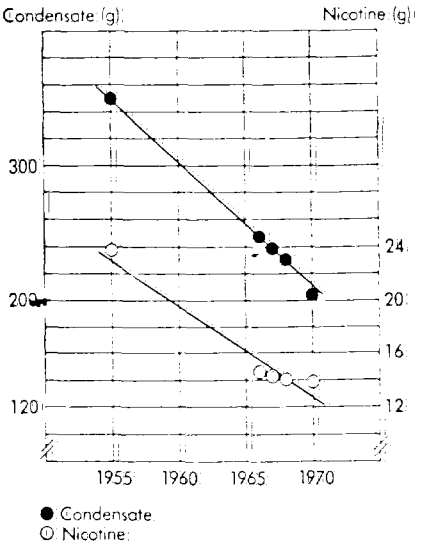
USA

Condensate and nicotine per smoker and per year (1955 – 1970)

Year	Condensate (g)	Nicotine (g)
1955	349	23.7
1966	248	14.6
1967	238	14.3
1968	232	14.1
1970	209	13.8

The overall trend is shown in figure 8.

Figure 8
USA
Smoke condensate and nicotine per smoker and per year
1955–1970



In the following data from Germany (11) the additional influence from the increase in cigarette butts has also been accounted for.

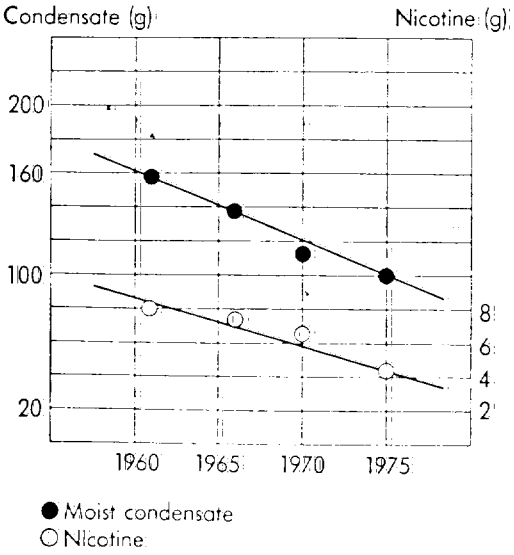
TABLE 8

GERMANY
Condensate and nicotine per smoker and per year
(1961 – 1975)

Year	Moist condensate (g)	Dry condensate (g)	Nicotine (g)
1961	158	–	8.0
1966	138	130	7.4
1970	113	108	6.2
1975	101	93	4.4

The decrease is illustrated in figure 9.

Figure 9
Germany
Smoke condensate and nicotine per smoker and per year
1961–1975



In spite of an increase in cigarette consumption, condensate and nicotine per smoker have decreased considerably both in the U.S.A. and in Germany.

TABLE 9

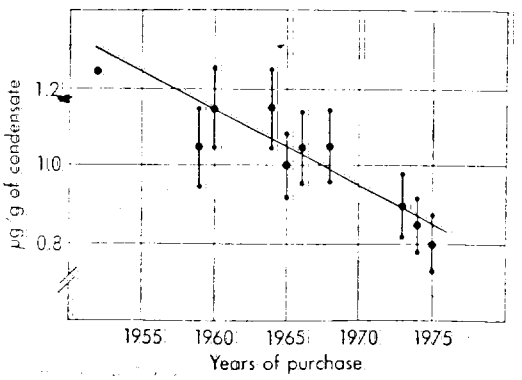
USA and GERMANY
Increase in cigarettes, decrease in condensate and nicotine per smoker
(1955 – 1975)

	Period	Changes per smoker (%)		
		Cigarettes	Condensate	Nicotine
USA	1955 - 1970	+11.6	−40.1	−41.8
GER	1961 - 1975	+36.2	−36.1	−45.0

Between countries the data on condensate and nicotine cannot directly be compared.
Tobacco selection, modern procedures of cigarette manufacture and changes in smoking habits have influenced amount and concentration of *all* smoke components. Some examples of constituents in the particulate phase, of gases and volatiles will be given in the next sections. The reduction of the smoke components chosen may well be taken as indications for drastic qualitative changes of tobacco smoke.

Benzo (a) pyrene
Amount and concentration of benzo (a) pyrene to which so much attention was devoted during recent decades have been reduced considerably, as may be seen from the results of repeated determinations in the smoke of a leading US-cigarette (58 - 67).

Figure 10
USA
Decreasing concentration of benzo (a) pyrene in the condensate of a leading non-filter cigarette (Hoffmann, 1952–1975)



Twenty years ago, the reproducibility of methods for the determination of BaP was not very good. The data in figure 10 have, therefore, been quoted from the publications of one laboratory (68). The addition of one single value obtained in 1952 (69) prolongs the decreasing trend over a period of twenty-three years. During this time, the concentration of BaP in condensate decreased by 36 %, which indicates a distinct selective reduction.

2. *Vapor phase*

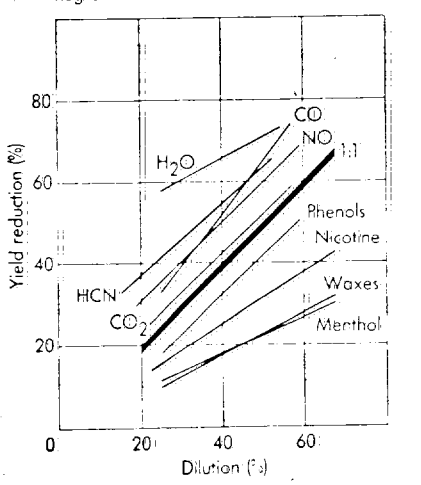
No data are available on long term trends but the positive correlation between total particulate matter and total vapor phase (37) does indicate that modern methods of cigarette manufacture have also reduced the total vapor phase.

Main factors for the reduction of gases are nowadays all kinds of dilution with air. On the other hand, volatiles are most effectively reduced by selective filtration. For both parts additional influences come from changes in smoking habits (longer butts, smaller puff volumes).

Gases

Recent data are available showing the influence of dilution with air achieved by paper porosity and perforations in paper or filter tipping.

Figure 11
Relation between the dilution (%) of cigarette smoke and the reduction (%) of selected smoke constituents (Norman, 1974)



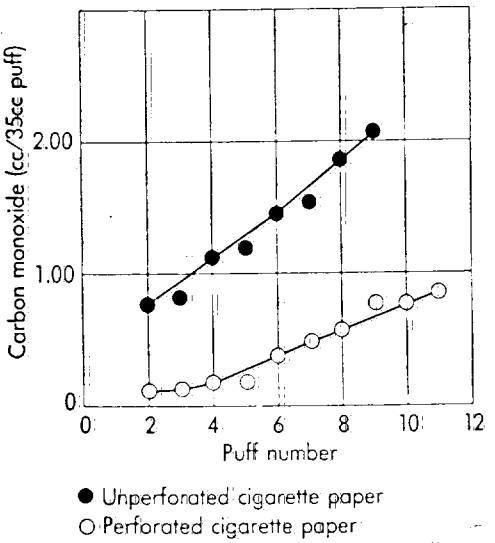
NORMAN (1974) has demonstrated selective reduction of

carbon monoxide
hydrogen cyanide
nitrogen oxides

and other gases as a result of dilution with air (70).

In line with this, RICKARDS (71) has shown that the selectivity factor for the reduction of nitrogen oxides by discrete line perforated paper can be as high as 1.3 or 1.6 and that carbon monoxide is also drastically reduced by this type of ventilation.

Figure 12
Concentration of carbon monoxide in cigarette smoke by puff number (Rickards, 1966)



Further means for the reduction of carbon monoxide are expansion of tobacco to achieve low specific density and the use of tobacco substitutes (72).

In the case of hydrogen cyanide selective filtration is achieved by activated charcoal and other adsorbents. Almost complete removal seems nowadays to be possible.

To include all factors of modern cigarette manufacture, it must be added that an increase of carbon monoxide may occur, if certain types of reconstituted tobacco sheet are employed (72, 73). HARKE was, however, able to show that not all types of such materials will cause an increase in carbon monoxide (74).

Some correlation data are available pointing at reduction of both particulate matter and carbon monoxide as a consequence of employing the methods mentioned above in modern cigarette manufacture.

Figure 13:
Swiss cigarettes 1976
Correlation between the yields of condensate and carbon monoxide (mg/cig)

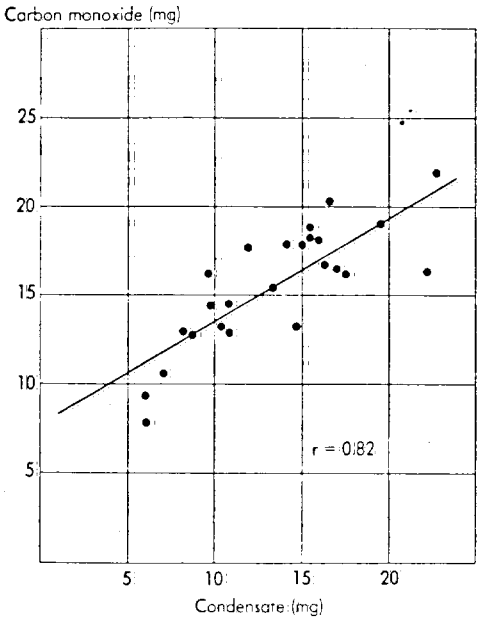
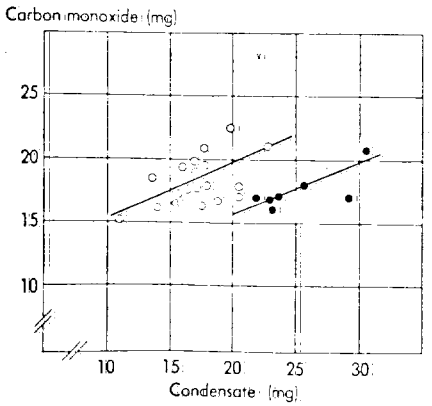


Figure 14:
German cigarettes 1975
Correlation between the yields of condensate and carbon monoxide (mg/cig)



○ filter cigarettes (r = 0.52)
● plain cigarettes (r = 0.77)

26 brands, 91,7 percent of the market

A positive correlation between condensate and carbon monoxide has also been observed in twenty brands of Canadian cigarettes (78).
Such correlations do support the view that carbon monoxide per cigarette has decreased along with the reduction of condensate. The positive correlation found in non-filter cigarettes may, in fact, point at a long term trend.
In addition to factors typical for the design of modern cigarettes, the smokers have reduced the yield of carbon monoxide by the increase of cigarette butts and the decrease of puff volume.
– The last two puffs of a non-filter cigarette are delivering 36 % of the total yield of carbon monoxide (71).
– Decrease in puff volume leads to a marked decrease of carbon monoxide per cigarette (80).

Volatiles and semi-volatiles
Dilution by air results in the decrease of many volatiles and expansion of tobacco (69) can reduce phenols to a very high degree (around 90 %), but filtration is most important.

Selective filtration
Between 1963 and 1965 the members of the CORESTA Smoke Study Group were greatly challenged by the demand for reduction of phenols (81). Based on the now classical studies by WALTZ, CUZIN, GRAHAM and other members of the group, DAVIS, LIPP and NEURATH were able to express the selectivity of a given filter for a given compound by a number of dimensionless quantities (82, 83, 84, 85, 86, 87).
The first success in those days was the demonstration of the selective removal of phenols (up to 90 %) by cellulose acetate filters (88).
The basic concept could later be enlarged and formulated more precisely. In 1975 MORIE and others were able to use distribution coefficients, solubility and vaporization as parameters for a formula by which selectivity can be calculated and predicted (89, 90).
If activated charcoal or other additives with adsorptive properties are included, modern technology achieves selective filtration of volatile nitrosamines (91), formaldehyde, acrolein, acetaldehyde (92) and it is conceivable that most volatile smoke components may almost be influenced at will.

In figure 13 values for condensate (mg) and CO (%) are from (75), number of puffs, mg CO and correlation from (76).
In figure 14 values for condensate, CO (Vol %) and puffs per cigarette are from (77), CO (mg) is calculated from these values.

Phenols are further reduced by the smokers' tendency to leave longer cigarette butts. The last two puffs of a plain cigarette contain 25.8 % of total particulate matter but 30.2 % of phenols (79). Similar findings are reported elsewhere in the literature (82, 88).

TABLE 10

Comparison between observed and calculated selectivities by cellulose acetate filters (MORIE, 1975)

Compound	Sx observed	Sx calculated	Difference	Difference %
Limonene	0.90	0.97	0.07	8
Ethylcyclopentene	0.90	1.13	0.23	26
Eugenol	1.00	1.14	0.14	14
Methylindane	1.10	1.18	0.08	7
Cumene	1.20	1.07	0.13	11
3-Heptyne	1.20	0.92	0.28	23
Methylindene	1.30	1.18	0.11	8
Indene	1.30	1.60	0.30	22
2-Cyclopentanone	1.50	1.64	0.14	9
Ethylphenol	1.60	1.20	0.40	25
Pyridine	2.00	2.04	0.04	2
2-Picoline	2.00	1.88	0.12	6
o-Cresol	2.20	2.33	0.13	6
Acetylfuran	2.20	2.20	0.00	0
5-Methylfurfural	2.50	2.06	0.44	18
Phenol	2.70	2.64	0.05	2
Furfural	2.80	2.40	0.40	14
Furfural alcohol	2.80	2.92	0.12	4
Pyrrole	3.10	3.11	0.01	0

Sx = Selectivity

3. *Residues from agricultural chemicals*

Although belonging to the changes achieved by modern agricultural methods, a short paragraph on residues from plant protectives may be added.

The concern of health authorities about possible effects of certain agricultural chemicals has prompted efforts to reduce the residues from such chemicals on tobacco. Reduction towards elimination has practically been achieved in a great number of these chemicals. In table 11 and figure 15 a few examples are given (93). Both the total imports and that from three main suppliers show drastic reductions. The trend has continued and is similar to that of residues from aldrin, dieldrin, endrin, heptachlorepoxide and others. Practical elimination of these residues may well be achieved before long.

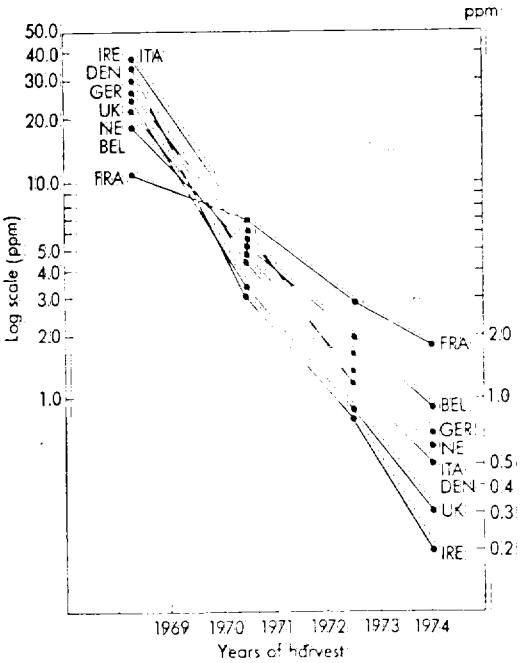
TABLE 11

Residues of DDT (ppm) in raw tobacco from selected countries of origin

Year of harvest	USA	BRAZIL	GREECE
Up to 1969	52.1	10.5	13.7
1974	0.2	1.6	0.1

Data are from 5,200 samples of raw tobacco imported by the European Community.

Figure 15
Residues (ppm) from DDT in raw tobacco imported by the individual states of the European Community.



TOBACCO SUBSTITUTES

Tobacco substitutes have widely been discussed but very little has been published. In a 100 % blend the materials will probably be unacceptable for reasons of quality and even a 50 % blend will most probably still not be accepted by the smoker. Tobacco substitutes will, therefore, most likely be blended with

tobacco but in relatively small proportion (45, 94). They will mainly have to perform some function of dilution. Such dilution does, however, result from many other factors of modern tobacco technology some of which are mentioned above. It remains, therefore, to be seen whether new aspects will emerge from ongoing research with these materials.

DISCUSSION

Some twenty years have passed since tobacco science was faced with official reports on smoking and health. In those days tobacco scientists, confronted with a host of conflicting evidence and challenged continuously by results from most sophisticated research – both in physics and in chemistry – succeeded in creating new concepts of quality. Oriented at the desires and the need of the consumer, tobacco science was developed with considerable efficiency and focused on the development of new products.

These are now at the smoker's disposal and compared with the respective products available some twenty years ago, the changes in modern cigarettes are so profound that we may now properly ask whether the reasoning in the old reports on smoking and health is still applicable.

We will, therefore, have to consider statistics, chemical findings and bioassay upon which the conclusions of these reports are based.

Statistical association

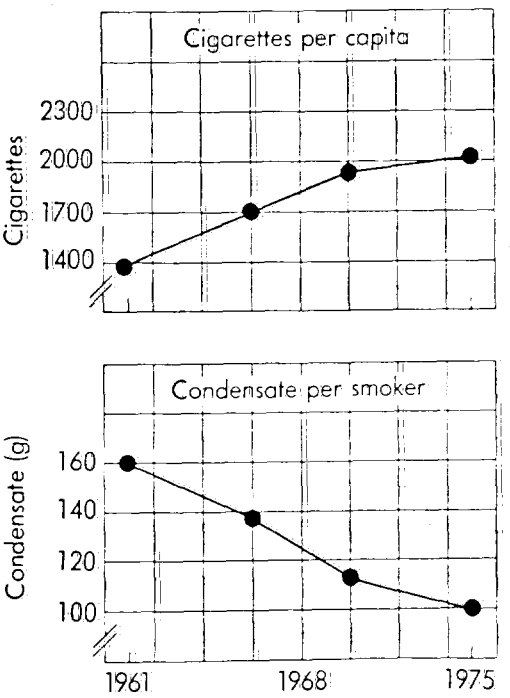
It has widely been stated that the increase in certain diseases is correlated with an increase in cigarette consumption. The latter is mostly taken from the sales of cigarettes per capita and this measure has become meaningless in the light of the changes described above. The parameter smoke per smoker has much greater relevance and this measure has decreased considerably during the past twenty years.

In Germany, cigarettes per capita have been on the increase, but condensate per smoker showed a drastic decline between 1961 and 1975. As described above, smoke per smoker has decreased accordingly.

This parameter is, therefore, negatively correlated with all disease rates and mortalities which are on the increase.

It may be argued that it is still too early to observe a decrease in chronic neoplastic diseases, and, in fact, an extremely important point in the reasoning of the old smoking and health reports is the claim of epidemiologists like DOLL (95) and CLEMMESEN (96) that mortality in 1950 and cigarette consumption around 1930 were perfectly correlated. In a somewhat typical way, cigarettes per capita and a latent period of twenty years have ever since been used to calculate trends of this type and to predict a rapid increase in the incidence of some neoplastic diseases (97).

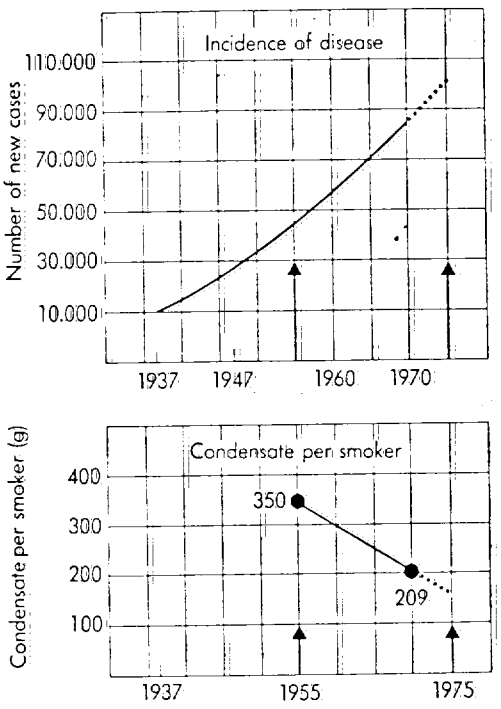
Figure 16
Germany
Cigarettes per capita and moist condensate (g) per smoker and per year (1961–1975)



In the United States, condensate per smoker has, however, started to decrease more than twenty years ago and since those years an impressive negative correlation between this parameter and the incidence of neoplastic lung diseases has developed.

Diseases with a latent period up to some twenty years and claimed to be tobacco related would right now have to decrease very rapidly or the health authorities will be faced with the problem of explaining a negative correlation.

Figure 17
USA
Incidence of neoplastic respiratory disease compared with cigarette smoke condensate per smoker and per year



Smoke chemistry
In the course of the past twenty years, the changes in cigarette design have not only resulted in a decrease of total smoke per cigarette but also in some important changes in smoke compositions. Smoke constituents like benzo (a) pyren, hydrogen cyanide, nitrogen oxides, carbon monoxide, volatile nitrosamines, formaldehyde, acrolein, acetaldehyde, phenols and other volatiles have been reduced selectively. Total vapor phase has been reduced at least at the same rate as condensate and finally, residues from some of the older plant protectives have almost completely been eliminated. Most of the substances mentioned may be regarded representative indicators for whole classes of chemicals. Not a single one of these so called « incriminated substances » has remained unchanged in concentration and/or in quantity delivered in the smoke. Whatever has been published about their relevance will certainly have to be re-evaluated.

Bioassay
Many official statements on smoking and health cite evidence from animal experiments such as those involving the painting of cigarette smoke condensate on mouse skin. This bioassay test was established and has been accepted as a standard for more than twenty years. Already during the first ten years, a decrease in bioactivity by 50 % of condensate from a standard commercial cigarette has been observed in this test (98) and there is little doubt that this trend has continued. This is in line with the findings from chemical analysis of smoke and leads to the conclusion that the changes in cigarette composition and design are now resulting in smoke which is certainly less active biologically and, therefore – if judged by the criteria used in official reports – less of a health hazard.
Further support for this conclusion is obtained from investigations in the U.S.A., Germany and elsewhere which reveal that extraction, expansion, changes in tobacco blend, and the use of reconstituted tobacco also greatly reduce the biological activity of cigarette smoke condesnate on mouse skin. Consequently, we not only have a reduction in the amount of condensate delivered per cigarette, but also a reduction in the specific activity per gram of smoke condensate.

CONCLUSION

From all these considerations it is clear that the older bases of concern about cigarettes as a factor detrimental to the health of the smoker have been seriously undermined by the changes which have been produced in commercial cigarettes during the past twenty years. The major statistical associations based on surveys between 1951 and 1959 have involved smokers of the strong, non-filter cigarettes consumed in those days. But these cigarettes have disappeared many years ago and consequently the old statistics do really no longer apply to present or future conditions. By various changes in cigarette design the exposure of smokers to incriminated smoke constituents has been drastically reduced or eliminated. Results of animal experiments in the last decade have confirmed qualitative improvements in the smoke condensates from modern cigarettes as compared to those of two or more decades ago. Basic concepts of

tobacco science developed twenty years ago have shown to lead in the right direction and have resulted in the improvement of tobacco quality in such a way that the future pleasure of the smoker seems to be assured.

The list of references may be obtained from the author.

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Ten Chapters on Olfaction

Dix Chapitres sur l'Olfaction

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SUMMARY

Olfaction is a very aesthetic sensation.
Good odors have functions to elevate our mental activities and even our personalities. Japanese people in old ages noticed this function and created the Kōdō, incense ceremony, just as they did the tea ceremony and flower arrangement.
Olfaction is a very important sensation.
Humans and animals have been able to avoid enemies and to protect themselves by this sensation in many cases. In other cases, they have been able to find their food or prey by it. Many animals have their living territories, indicated by their specific odors, the so-called pheromones. Animals which live in groups identify each other by their body odors.
Olfaction is an erotic sensation.
Animals are in heat one or more times a year. In that time, female animals attract the males or *vice versa* by their pheromones.
Olfaction is a very unique sensation.
It is accompanied by likes and dislikes in most cases. Individual differences in acuity and preferences are very marked. Moreover, individual acuities and preferences change, depending upon one's state of health.
Olfaction is a very sensitive sensation.
In case of the great majority of odors, olfaction is superior to the most sophisticated scientific apparatus, such as the gas chromatograph.
Olfaction is a very unreliable sensation.
When smelling the same odor continually, a person easily fatigues. And in the case of a toxic gas, one often may not detect it as it gradually increases in concentration from very low to high. Thus, one often loses one's life.
Olfaction is a sensation very abundant in variety.
Nobody knows the exact number of different odors. Some chemists presume the number is 400,000, because the number of organic chemicals is about 2 million and one fifth of them are supposed to be odorous.
Olfaction is a very primitive sensation.
It has a very close relation with appetite and sex. The olfactory nervous system belongs to the old part of the brain. It does not show much development among the vertebrates, from the lowest to the highest, as compared with the other sensory systems.
Olfaction is a very unpleasant sensation.
Oder pollution has become one of the subjects about which people most frequently complain. Like the other sensations, it is believed subject to the famous Weber-Fechner's law. Even if industry by rare chance should succeed in the elimination of 99 % of the bad oder, people in the neighborhood still could smell one third of the original odor and their complaints would remain. To monitor the oder pollution, it is essential to organize the olfactory panel. In order to select people and to measure the olfactory acuity, a new olfactometer has been deviced.
Olfaction is a sensation which may be influenced by smoking.

RÉSUMÉ

L'olfaction est une sensation très esthétique.
Les bonnes odeurs ont la propriété d'élever nos activités mentales et même nos personnalités. Les anciens japonais avaient remarqué ce fait et ils créèrent le « Kodo », ou la cérémonie des parfums, comme ils le firent pour la cérémonie du thé ou l'arrangement floral.
L'olfaction est une sensation très importante.
Les humains et les animaux ont été capables de se protéger ou d'éviter leurs ennemis grâce à cette sensation. Dans d'autres circonstances, il leur a été possible de trouver par là leur nourriture. Beaucoup d'animaux délimitent leur espace vital ou leur territoire de chasse par leurs odeurs spécifiques, appelées phéromones. Ceux qui vivent en groupe s'identifient par leurs odeurs corporelles.
L'olfaction est une sensation érotique.
Les animaux ont, une ou plusieurs fois par an, une période de rut. A ces moments, les femelles attirent les mâles, ou *vice versa*, par leurs phéromones sexuelles.
L'olfaction est une sensation tout à fait unique.
Dans la plupart des cas, elle s'accompagne de goût ou de dégoûts. Les différences individuelles en acuité et en préférences sont très marquées. De plus, elles varient avec l'état de santé.
L'olfaction est une sensation très sensible.
Pour identifier une grande majorité d'odeurs, l'olfaction est supérieure aux appareils scientifiques très modernes, tels ceux de la chromatographie gazeuse.
L'olfaction est une sensation dangereuse.
Elle fatigue facilement, si l'on sent continuellement les mêmes odeurs.
Même s'il s'agit d'un gaz dangereux, sa présence est difficilement remarquée s'il augmente en concentration de façon graduelle, d'un niveau très bas à un niveau très élevé et on y retrouve une cause fréquente d'accidents mortels.
L'olfaction est une sensation riche.
Personne ne connaît le nombre exact des odeurs différentes. Certains chimistes l'estiment à 400 000, parce que le nombre d'éléments chimiques organiques est d'environ 2 millions et qu'un cinquième d'entre eux sont supposés être odoriférants.
L'olfaction est une sensation très primitive.
Elle possède une relation très proche avec l'appétit et le sexe. Le système nerveux olfactif appartient à l'ancienne partie du cerveau. Il ne présente pas beaucoup de développement chez les vertébrés, du haut en bas de l'échelle, si on le compare à d'autres systèmes sensoriels.
L'olfaction est une sensation très pénible.
La pollution par l'odeur est devenue un des principaux sujets de plainte du public. Comme les autres sensations, on estime que l'olfaction est sujette à la célèbre Loi de Weber-Fechner. Même si, par hasard, les industries parvenaient à éliminer 99 % des mauvaises odeurs qu'elles causent, les gens habitant dans le voisinage pourraient encore percevoir un tiers des odeurs originales et leurs plaintes n'en seraient pas calmées pour autant.
Pour contrôler la pollution par les odeurs, il est essentiel d'organiser une commission chargée des questions olfactives. Afin de choisir les personnes et de mesurer l'acuité olfactive, un nouveau olfactomètre a été conçu.
L'olfaction est une sensation qui peut être influencée par le tabac.

It is a great honor that I could have a chance to talk on olfaction, a subject of my life work to such distinguished guests from all over the world. I am grateful indeed to Dr. A. Artho, President of the Scientific Commission of CORESTA and President, Mr. M. Izumi, and the members of the Organizing Committee for giving me this opportunity.

In the beginning, let me introduce myself. I am a neurophysiologist and have been studying how odorous molecules stimulate the olfactory receptor cells, then what kind of nerve messages the receptor cells elicit and to where in the brain they are conducted. I am going to talk on these problems later, but first, I would like to speak on olfaction in general.

Chapter I
Olfaction is a very aesthetic sensation

Good odors have functions to elevate our mental activities and even our personalities. It is said that cultivation of new voyage routes

to the Orient by Europeans was mainly to acquire new perfumes. The perfumes have been treasured from the old times in the Orient, and in Japan as in Europe. But the use and kinds of the perfumes seem a little different in Japan. The Japanese people have very slight body odors. Consequently, they have not had necessity or customs of modifying their body odors by spraying perfumes on their bodies. The perfumes in Japan have been used mainly to dignify the atmosphere of ceremonies and rituals, to ornament their rooms or to scent their costumes by burning the incense woods. In recent Japan, however, the perfumes which Europeans use are widely imported and are used also as cosmetics in the same way as in Europe. But the incenses which were used in old Japan still remain and are used on many occasions.

The origin of incense-burning in Japan can ultimately be traced to India through China. The chief use of incense in China was in connection with Buddhist worship. When Buddhism was introduced to Japan from China, a custom of incense-burning naturally followed it. Besides, a story about a scented wood has been well known. About 630 A.D., a big wood log drifted ashore the Awaji Island near Osaka. When the villagers burnt it, they found it emitted a wonderful odor. Hearing it, Prince Shotoku ordered them to procure the wood. Since then scented woods were imported from China and Korea and were used in the ceremonies of Buddhism. In the next era, named « Heian era » which continued from the 8th to the 12th century, incenses began to be used in the daily life of the aristocrats. The peers used incenses to scent the guest rooms, clothings and appointments prior to their use. Furthermore the peers devised a game of incense-matching. The nobles competed with each other as to who could judge correctly two identical odors among ten sniffed.

In the following period, the « Ashikaga era » which lasted to the 16th century, the religious factors declined in the use of the incense, and instead, aesthetic factor began to be more and more favored. It is said that « Kō-Dō » or incense ceremony was born in Japan in the middle of the fifteenth century, when general Yoshimasa Ashikaga governed Japan on behalf of the Emperor. The general liked this aesthetic recreation so much that he wanted to formulate a code of etiquette for incense-burning. A peer, Sanetaka Sanjonishi and a warrior Soshin Shino did it with the aid of some of the officiators of tea ceremonies. Nowadays, there remain only two sects : one is an aristocratic sect, named « O-i-e-ryu » which was founded by Sanjonishi and has been popular among the members of the Imperial Household and Court nobles as it is today. The other is the Shino-sect and was popular among the feudal lords, warriors and the people in general. Today, the aristocratic sect is popular in Tokyo area and the Shino-sect is enjoyed by people in general in Kyoto and Nagoya areas.

Chapter 2

Olfaction is a very important sensation

Animal life fundamentally consists of protection of the body and protection of its family. To protect the body, an animal has to catch and eat its prey or eat proper vegetables or fruits. On that occasion, the animal has to select what is edible and what is not. This can be done by olfaction. On another occasion, it has to escape from its enemy so that it may not become a prey. Olfaction again shows its powerful ability. Humans in old times knew from the long experience that they had to approach their games from the leeward in order to catch them. Thus, they knew how to use even the weak point of olfaction.

Wild animals have their living territories in fixed areas and have their nests inside them. In order to protect and mark the territories, they walk along the environs of the territories every day and put special odors, namely « pheromones » on the ground or on trees by urination or by secretion from the special glands. This is a custom named « marking ». Other animals, sniffing these odors, know the presence of a dweller and do not dare to invade it. If another animal invades it, the dweller makes a counterattack furiously.

Weak animals often live in groups. In those cases, how can they know that the other animals are comrades of the same family? In the group life, how can the new born find out their mothers? It is well known that olfaction plays a most important role in these cases. The odors which are embedded in the very early period after their birth, decide the futures of the animals. This is a famous phenomenon named « imprinting ». The young, drinking milk from their mother, remember the odor of their mother and through the mother odor remember the odor of the animal family. By this odor they can find out their comrades even at night.

This is the case in the world of fish. Fishes who live in groups, for instance sardines, can gather even in muddy water or at night.

Smelling the common odor of the family; they live in groups.

Next, my speech is concerned with the protection of the family. If a fish in a group is attacked and bitten by a bigger fish, a special odor, again a kind of pheromone is liberated from the body. Sniffing the odor, the other fishes instantly scatter and escape from the enemy. This odorous substance was called « alarm substance », or in Deutsch « Schreckstoff » by Dr. von Frisch, a Nobel prize winner in Munich. At the sacrifice of a fish, the lives of the other fishes are saved. This is one of the arts of nature. My speech on the protection of the family continues in the next chapter.

Chapter 3

Olfaction is an erotic sensation

Olfaction has a deep relation with sex. In order to protect the animal family, males and females have to meet each other and produce their youngs. Animals which are living independently try to find out their spouses, when heating period comes, and copulate. For this purpose, females emit special odors, pheromones, and attract the males during that period. Sometimes males emit pheromones. For instance, a musk deer does. Such a pheromone is needed even in animals which are living in group life. Heating periods shift from a female to a female, and are not coincident. Consequently, male animals have to find out which females are in heat.

But such finding only from the appearance may be very difficult and it has to depend upon olfaction. A pheromone emitted by a female is also known to evoke copulation itself.

Abortion can be elicited by an odor. Dr. Bruce in England proved such a phenomenon clearly, using pure blooded mice. When a pregnant mouse in its early period meets a male mouse of a different pure blood, it miscarries. When the uterine movement is recorded by means of an inserted balloon, we found that the movement is influenced by some odors.

When I heard the names of such abortive odors, I tried to prove or disprove a possibility that they may produce abortion in humans. I asked three girls in my laboratory to measure their basal temperatures every morning for three months. Thus, I could anticipate their ovulation days. I started my experiment by letting the three girls sniff the odors from just before the anticipated ovulation days. Alas! I found that my experiment had to be discontinued. It was because the girls found the odors very disagreeable, and rejected to continue sniffing of the odors any longer. It is strange that men do not find the odors disagreeable. My experiment which was started, expecting the sincere thanks of all the ladies in the world turned out to be a failure.

Chapter 4

Olfaction is a very unique sensation

Olfaction is similar to taste in that chemical substances become stimuli and hence both are collectively called « chemical senses ». The two senses are in most cases accompanied by a feeling of like or dislike and in this respect they are very different from the other senses, vision and audition. To express grades of like and dislike, a hedonic scale is devised. There are nine degrees from +4 (extremely pleasant) to 0 and to -4 (extremely unpleasant). Thus, we can express grades of pleasantness and unpleasantness by numbers.

Olfaction has a close relation with health. When we catch cold or when we are very tired, olfactory ability declines. Also, olfaction is influenced considerably by hormones. In case of women, preference of odors and acuity of olfaction may change during the periods of puberty, menstruation, pregnancy and menopause. Even in men, olfactory sensitivity is known to rise after injection of sex hormones. Thus, it is unique that olfaction is markedly influenced by the conditions of our body.

Besides, olfaction is unique in that individual difference in the acuity is very marked. Some people believe that they have excellent olfactory sensitivity, but in fact their olfaction may not encompass all kinds of odors. Close examination of olfaction, using many kinds of odors may disclose that their noses are not sensitive to some kinds of odors. In extreme cases, some people can not smell one or a few kinds of odors, although their olfactory abilities are just normal for the other odors. This phenomenon is called « olfactory blindness ».

Chapter 5

Olfaction is a very sensitive sensation

Human olfaction is in a great majority of cases superior to a gas chromatograph, the most advanced scientific apparatus for odor measurement.

A director in a curry powder company in Japan has a remarkable olfaction. When he comes to the company every morning, he sniffs around in the factory. When his nose detects something different, he always finds

that there exist some troubles in the machines. His company entirely depends upon his olfaction. A perfumery company in France tried to analyze the odor of a rose. Using a gas chromatograph, they analyzed 95 % of the components. When they mixed those components in the same proportions, they could not find the original odor of the rose. Then, they wanted to analyze the remaining 5 %. To develop newly a gas chromatograph with a higher sensitivity costs very much. Besides, with that apparatus nobody could foretell how many more components can be discovered. So they decided to ask a perfumer to analyze it. The results were remarkable : he found two hundred kinds of components in the remaining 5 %.

Finally, some exceptions are noteworthy. In case of acetone, the gas chromatograph is superior to our olfaction by 17,000 times, and in case of 2-butanone, it is again superior by 10,000 times.

Chapter 6

Olfaction is a very dangerous sensation

One's ability to smell easily fatigues when one sniffs the same odor continually. But even then, one's ability to smell different odors is just normal. This phenomenon is called « selective fatigue ».

This property of olfaction is very dangerous, because one can not notice the odors of a city gas and a propane gas when they gradually increase in concentration. When these gases leak slightly, people in the room can not be aware of them and fall into carbon monoxide gas poisoning. If other people do not come from the outside and help the poisoned people, they will lose their lives.

Selective fatigue, on the other hand, has a merit that one can work or live in an environment which is full of bad gases. In the factory which produces bad odors, the workers do not object to them due to the olfactory fatigue. But the people in the neighborhood complain of it, because bad odors visit them intermittently, depending upon the direction of the wind, and the olfactory ability of the people is practically freed from the olfactory fatigue all the time.

Chapter 7

Olfaction is a sensation very abundant in variety

How many odors are there in our world? Nobody knows exactly. A chemist presumes that the number of organic chemicals is about 2,000,000 and one fifth of them may be odorous. If so, the number of odorous substances are about 400,000. This is only an estimation, but nobody will disagree to the view that the number of odors is quite numerous.

It is generally believed that all sorts of colors are composed of the three fundamental colors, red, green and blue and that all kinds of tastes are made of four fundamental tastes. Then, how about odors? How many kinds of fundamental odors are there? Isn't a search for the fundamental odors promoted by the examination of the olfactory blindness, just as in the case of the three fundamentall colors? Following up on this idea, Dr. J. E. AMOORE, an official of the Department of Agriculture at Berkeley in California has continued his research and indicated the following odors as the fundamental ones : Iso-valeric acid—an underarm sweat odor, L-pyrroline—a semen odor, Trimethylamine—an odor of the menstrual blood, Musky smelling steroids—a urine odor. He is going to add many more odors. He presumes that very probably there exist 20 to 30 fundamental odors.

Chapter 8

Olfaction is a very primitive sensation

It was already stated that olfaction has a deep relation with appetite and sex. The part of brain which was shown to participate in olfaction belongs to the phylogenetically old brain. This part does not show much development from the lower to the higher animals. In other words, this part in the higher animals is still in the primitive stage of development, very different from visuall and auditory parts of the brain. The olfactory receptor cells, when stimulated by odorous molecules, send nerve messages to the several parts of the brain, but it has not been well known where and how they are processed, to where they are sent eventually, and where delicate sensations of odors are elicited. In the other sensory systems, destinations in the new part of brain, the so-called neocortex, of the sensory nerve messages have been clarified, but in the olfactory nervous system, the destination in the neocortex has not been proven.

Recently our studies on the monkey proved that an olfactory area exists in the orbital cortex of the prefrontal lobe, which is a part of the neocortex. By a behavior experiment and by recording of the nervous activity, we showed that fine discrimination of the differences of odors is performed in this area. It was also found that the nerve pathway up to here passes through the hypothalamus, but not through the thalamus, through which all

the other sensory nerve messages always pass. In this respect the olfactory nervous system is very unique. But we still do not know whether or not this unique nerve pathway is related to the unique nature of olfaction.

Chapter 9
Olfaction is a very tedious sensation

Bad odors from several factories are the subjects which Japanese people nowadays most frequently complain of. After the last world war, especially since about 1950, development of industries in Japan has been marvellous, but accompanying it, odor pollution has emerged as a big social problem. A big target in the 1970s is supposed to establish effective countermeasures to these problems.

Olfaction is also believed to obey the famous Weber-Fechner's law. If so, what kind of tedious problem results? Suppose that a company by a rare chance should succeed in the elimination of 99 % of the bad odor. Do people in the neighborhood discontinue to complain? The answer is "No". They can still smell the bad odor at the intensity of one third of the original one. Since elimination of 99 % of bad odors is almost impossible, you could understand how difficult it is to regulate odor pollution. The best policy is clear. It is to create an entirely new process to manufacture the same or a better product without emitting an odor.

In order to regulate bad odors, it is necessary to organize an « olfactory panel » from the inhabitants in the polluted area. By an olfactory panel is meant a team of inspectors usually 5 to 10 in number, who have an average ability of olfaction. Then, how can we find such people with an average olfactory ability? For this purpose, together with many collaborators who are otorhinolaryngologists, psychologists, and perfumers, I have endeavored to make a standard olfactometer. We all tested men and women of 18 to 25 years old in various areas, using ten different kinds of odors, and sought both the detection and the recognition thresholds. From these results, a series of test solutions which are arranged in 8 stages from high to low concentrations were made. It was named a T & T type olfactometer. Olfactory panels in Japan are going to be selected, using this olfactometer.

Chapter 10
Olfaction is a sensation which may be influenced by smoking

In front of today's audience who are tobacco specialists and other interested persons, it is difficult to end my speech without referring to the relation between olfaction and tobacco. What kind of relation does exist between them? When I prepared a manuscript for today's speech, I sniffed several kinds of cigarettes. Their odors were splendid. Each kind has its own individual character. I felt strong temptation for cigarettes. It is well known that the so-called « taste » contains many components. It contains not only sensations of tongue, namely sweetness, bitterness, sourness and saltness, but also sensations of warmth and coldness, sensations of touch, pressure and even light pain. And moreover, olfaction plays an important role in the « taste ». You can realize it when you drink coffee with your nostrils closed. Without olfaction how tasteless coffee is!

When, however, I asked tobacco smokers about the influence of the cigarette odors on the tastes of the cigarettes, to my surprise, nobody could answer correctly. It seems to me that a cigarette odor is fascinating when the cigarette is not lit, but that the odor may change in nature when a cigarette is lit and smoked. Consequently, the role played by a cigarette odor may not be important in the taste of smoking. Is my opinion correct? I, a non-smoker, do not have a right to speak more on this matter. Very probably someone of you, smokers, may answer me correctly.

Now, what kind of influence does tobacco have on olfaction? I have read some reports that smoking depresses olfactory ability. Of course, that depends upon how frequently one smokes. The reports also say that the olfactory ability recovered when one stopped smoking. On the other hand, a report said that cigarette smoking does not have any influence on olfaction, but cigar smoking does.

In any case, tobacco has been a very important article of luxury for mankind since very old times. It is so now, and it will be so in the future. In the end a new finding is introduced that tobacco is a favorite not only with mankind, but also with the monkey. Some day monkeys also may become good customers of cigarettes, although I do not believe it.

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ABSTRACTS

RÉSUMÉS

SECTION A1

Mechanization and General

Mécanisation et Généralités

Chairman — Président

A. DE BAETS

A101 LABOUTIERE H., GABRIEL C.

(In French) Development of mechanized tobacco harvesting in France from 1970 to 1976.

CFPPT, Bergerac, France.

In stalk-harvesting areas, a survey has been made along the following four lines : small, self-propelled cutting machines, tractor-mounted cutting machines, cutting-raising machines with trailer-born grouping operations, and larger automatic machines. The development of the small mechanical aids has come rapidly and quite naturally. The larger machines, used in a farming system which calls in question neither the field cultural practices, nor the curing process, nor the type of farm management, all prove to be complicated, very expensive and rather slow. The rentability barrier for the farmers as well as for the manufacturers seems to lie somewhere between the tractor-mounted cutter and the cutting raising machine with trailer-born grouping operations.

In the leaf harvesting areas, observation started in 1973 on the following machines : Foreign made machines, (picking team born on self-propelled machine with manual leaf-harvesting, and leaf-looping on platform trailer) various sized picking team carriers without leaf-looping, small « kart » type mechanical aids or high clearance machines. The survey group concerned, rapidly reached the conclusion that the use of the larger sized picking team carriers is not to be recommended. Planters today are inclined to build themselves, or to buy mechanical aids. These aids high clearance or not, are of reduced dimensions.

For the coming years, observations are being made on mechanical gathering, and the picking of wilted tobaccos for stalk-harvesting. For leaf-harvesting, they will bear on high clearance aids and automatic leaf-stripping.

A101 LABOUTIERE H., GABRIEL C.

Développement de la mécanisation de la récolte du tabac en France de 1970 à 1976.

CFPPT, Bergerac, France.

Dans les régions de récolte en tiges les investigations ont été développées dans quatre directions : petites machines automotrices, coupeuses montées sur tracteur, coupeuses-élévatrices avec chantier de groupage sur plateforme, grosses machines automatiques. Le développement des petits appareils a été rapide et naturel. Les grosses machines, dans un système ne remettant en question ni les procédés de culture sur champ ni le principe de dessiccation ni la structure de l'exploitation, se révélèrent toutes compliquées, très chères et peu rapides. Le mur de la rentabilité semble se situer aussi bien pour les agriculteurs que pour les constructeurs entre la coupeuse sur tracteur et la coupeuse-élévatrice avec plateforme de groupage.

Dans les régions de récolte en feuilles le travail fut commencé en 1973. On étudia : des machines étrangères (porte-cueilleurs automoteurs avec prise manuelle des feuilles et enguirlandage sur plateforme), des porte-cueilleurs de tailles diverses sans enguirlandage, des petits appareils de types « Karts » ou « Mini-Enjambeurs ». Un groupe de travail conclut rapidement que les appareils porte-cueilleurs de grande dimension ne devraient pas être encouragés. Actuellement, les planteurs sont disposés à construire eux-mêmes ou à acheter des appareils enjambeurs ou non mais de dimensions réduites.

Les études pour les années qui viennent portent sur : pour la récolte en tige, le groupage mécanique et le ramassage du tabac fané ; pour la récolte en feuille, les mini-enjambeurs et la défoliation automatique.

A102 NAITO T., KIMURA S.

Mechanization for tobacco culture in Japan.

Univ. Utsunomiya ; Utsunomiya Tob. Exper. Sta., JTS, Japan.

Two-wheeled tractors were introduced in Japanese farming after the end of World War II. Farm mechanization in Japan was developed only in the field of rice production. The priority of farm mechanization in Japan was given to rice production ; the development of, the improvement of, and the research into the utilization of machinery for rice production are being carried out and new machines are being developed and introduced. At this time, an integrated mechanization system for small-sized machines in rice production in Japan has been accomplished.

While remarkable progress has been made in the field of rice production, old-fashioned methods still prevail in the field of tobacco culture, especially in the harvesting operation. For the past decade mechanization for tobacco culture has been emphasized and new machines for tobacco culture are being developed and introduced into tobacco farms. Very soon, an integrated mechanization system for small-sized machines in tobacco culture in Japan will be accomplished in the near future. This paper presents a review of new machines for tobacco culture which were developed and are being developed at the tobacco experiment stations of the Japan Tobacco & Salt Public Corporation. Also, it deals with the present status of mechanization system for tobacco culture in Japan and machine performance.

A102 NAITO T., KIMURA S.

(En anglais) Mécanisation de la culture du tabac au Japon.

Univ. Utsunomiya ; Utsunomiya Tob. Exper. Sta., JTS, Japan.

Les tracteurs à deux roues ont été introduits dans les exploitations agricoles au Japon après la deuxième guerre mondiale. La mécanisation de la culture au Japon est apparue à l'origine dans le domaine de la production du riz. Les mises au point, perfectionnements et recherches se poursuivent toujours dans le domaine des applications pour la production du riz et de nouvelles machines sont mises au point et commercialisées. Depuis cette époque, le système de mécanisation intégrée à base de machines de taille réduite dans la production du riz est devenu un fait accompli.

Alors que de remarquables progrès ont été accomplis dans le domaine de la production du riz, les méthodes anciennes prévalent toujours dans celui de la culture du tabac et en particulier pour la récolte. Des efforts ont été accomplis au cours des dix dernières années pour moderniser la culture du tabac et de nouvelles machines ont fait leur apparition dans les exploitations de tabac. Prochainement un système de mécanisation intégrée à base de petites machines deviendra une réalité dans le domaine de la culture du tabac au Japon.

Ce rapport fait état de la mise au point de nouvelles machines destinées à la culture du tabac conçues par les centres de recherche du tabac de la Japan Tobacco and Salt Public Corporation. Ce rapport traite également des performances des machines et de l'état actuel de la mécanisation dans le domaine de la culture du tabac au Japon.

A103 SASAKI M., ASAI K., MIYAZONO T., SHIROZU A.

Development of the transplanter for covered-cultivation of tobacco in Japan.

Kagoshima Tob. Exper. Sta., JTS ; Saakuru Iron Co., Japan.

The plastic film covering accelerates the growth of tobacco in the early stages and also assures steady growth of tobacco and is now widely used in Japan.

It has been gradually improved. The so-called improved ridge covering method, in which the

A103 SASAKI M., ASAI K., MIYAZONO T., SHIROZU A.

(En anglais) Développement des machines à transplanter dans la culture du tabac sous couvert.

Kagoshima Tob. Exper. Sta., JTS ; Saakuru Iron Co., Japan.

La culture sous couverture de film plastique accélère manifestement les premiers stades de développement du tabac et stabilise sa production ; c'est pourquoi cette pratique est générale au Japon.

Elle s'est graduellement améliorée et la

seedling is covered with plastic film after transplantation is becoming very popular. About 80 % of the flue-cured tobacco producing areas in Kyushu now use this method.
The method, however, complicates the transplanting work and requires more labor. To save on labor, the authors investigated the transplanter fitting to the improved ridge covering method, and developed two types of transplanters during the period 1973-1975. One is tractor-mounted and the other is self-propelled and tractor-mounted. The self-propelled transplanter can turn in a small area and thus is highly suitable for the small fields which are prevalent in Japan.
It is highly efficient. It can transplant ca. 10 a per hour with an 80 % labor-saving as compared to conventional transplantation. The accuracy of this transplanter is ca. 90 %.
The farmers of Japan used 300 of the self-propelled transplanters in 1976, the year of its introduction.

A104 BEUCHAT A., CAMMILLI A.

(In French) Mechanization of topping, bud treatment and Bright tobacco harvesting : technical and economic aspects.

Ist. Sperim. Tab., Rome, Italie.

Tobacco cultivation has a particular importance in Italian agriculture, given the economic and social interests involved.
Development of tobacco cultivation in Italy has encountered serious obstacles in the form of a lack of manpower and continuous increases in salaries, which heavily influence production costs and, as a result, the competitiveness of Italian goods on the international market.
The object of this study was to examine the effects of mechanization on the reduction of working time and production cost quantitatively and qualitatively with respect to the morphological characteristics of the tobacco plants and the chemical composition of the leaves.
Tests were divided into two parts : One part was carried out on large pieces of land taking into consideration the machines themselves

méthode dite de « couverture du billon », dans laquelle chaque plantule est recouverte par le film plastique après avoir été plantée dans une cuvette, est de plus en plus populaire. Dans la région de Kyushu par exemple, 80 % environ des terres tabacoles sont cultivées selon cette méthode.
Mais cette méthode a pour inconvénient de compliquer la transplantation et d'augmenter le temps de travail. Dans le but d'économiser celui-ci, les auteurs ont mis au point des machines à transplanter spécialement adaptées à cette méthode. De 1973 à 1975, deux modèles ont été mis au point. L'un est monté sur tracteur et l'autre est automoteur ou monté sur tracteur. Le modèle automoteur peut tourner dans un espace limité ; il est donc bien adapté aux champs de petites dimensions qui prévalent au Japon. Son efficacité est grande. Il peut transplanter environ 10 ares de tabac à l'heure avec une économie de main-d'œuvre de 80 % par rapport à la transplantation classique. Sa précision de plantation est de 90 %. En 1976, année d'introduction de cette machine automotrice, 300 d'entre elles ont été employées par les planteurs du Japon.

A104 BEUCHAT A., CAMMILLI A.

La mécanisation de l'écimage, des traitements contre les bourgeons et de la récolte du tabac Bright : aspects techniques et économiques.

Ist. Sperim. Tab., Rome, Italie.

La culture du tabac présente, dans l'agriculture italienne, une importance tout à fait particulière, étant donnés les intérêts économiques et sociaux très importants auxquels elle est liée.
Le développement de la culture du tabac rencontre à présent, en Italie, des obstacles sérieux, tels le manque de main-d'œuvre et l'augmentation incessante des salaires, qui influent largement sur les coûts de production et par conséquent sur la compétitivité des produits italiens sur les marchés internationaux.
Le but de cet étude a été d'examiner les effets de la mécanisation sur la réduction des temps de travail et des coûts, sur les rendements en poids et qualité, sur les caractéristiques morphologiques des plantes et sur la composition chimique des feuilles.
Les essais one été subdivisés en deux parties :

(benefits, capacities, quantity and quality of work). The second part of the tests, carried out on repeated areas, examined the agronomic aspects, production, morphological characteristics, and the physical and chemical features of the tobacco.
The study was begun in 1974, but the readying of the machinery involved delays in the initiation of testing, and as a result, the observed data are not complete and must now be confirmed in the field. It is anticipated that the data will be available for presentation at the Congress in Tokyo.
The available results appear to confirm, on the whole, the technical and economic capacity of machines tested ; an increased freeing of manpower, estimated at 60-70 % ; a reduction in production costs of about 15-20 % ; and a reduction in unit production of about 15 %.

A105 KNEISZL F., SCHIPFER L.

Labor input in tobacco production with regard to 3 levels of mechanization.

Chamber of Agric., Graz ; Austria Tabakwerke, Wien, Austria.

The agrarian quota (persons employed full time in agriculture) in Austria declined by 60 % from 1951 to 1971 and has been falling since then, in similarity to other industrialized European countries.
Industrial wages are considerably higher than wages paid in agriculture. On the other hand, tobacco production costs have been increasing steadily ; namely, from 1970 to 1975, energy costs increased 65 %, fertilizer costs 96 %, plant protection costs 67 % and rural wages 99 %.
Due to climatic conditions, tobacco farmers are forced to erect expensive air-curing barns and other buildings, thereby increasing the production costs by 10-20 %.
During the period 1960-76 the number of tobacco growers in our country decreased by 80 % although the average tobacco price increased by 110 %.
For domestic tobacco there is neither a protective duty nor a buyer's bonus ; taxes on

l'une a été effectuée sur de grandes parcelles de terre et a pris en considération les machines par elles-mêmes (performances, capacités, quantité et qualité du travail accompli) ; la seconde partie des essais, effectuée sur des parcelles avec réplication, a considéré les aspects agronomiques, les productions, les caractéristiques commerciales et physico-chimiques du tabac.
Cette étude a été entreprise en 1974 ; la mise au point des machines a causé des retards dans le début des essais et par conséquent les données observées ne sont pas complètes et devront être confirmées dans la campagne en cours. On peut prévoir que ces données seront disponibles et pourront être présentées au Congrès de Tokyo.
Les résultats actuellement disponibles semblent confirmer, avec une large approximation la capacité technique et économique des machines expérimentées ; une économie élevée de main-d'œuvre qu'on peut chiffrer à 60-70 % ; une réduction des coûts de production de 15-20 % ; la production à l'hectare paraît diminuer d'environ 15 %.

A105 KNEISZL F., SCHIPFER L.

(En anglais) Heures de main-d'œuvre dans la production de tabac, considérant 3 niveaux de mécanisation.

Chamber of Agric., Graz ; Austria Tabakwerke, Wien, Austria.

Comme dans d'autres pays européens industrialisés en Autriche aussi la cote agraire (nombre des travailleurs dans l'agriculture) pendant la période de 1951-71 a diminué de 60 % ; le nombre baisse encore sensiblement depuis ce temps.
Les salaires industriels dépassent de beaucoup ceux qu'on peut obtenir dans l'agriculture. D'autre part les coûts de production du tabac se sont accrus rapidement pendant la période 1970-75 : ceux pour l'énergie de 65 %, pour les engrais de 96 %, pour la protection des plantes de 67 % et pour les salaires agricoles de 99 %.
Dans nos conditions climatiques, il faut construire des séchoirs permanents et chers, dont le coût augmente les dépenses annuelles de la production de 10 à 20 %.
De 1960 à 1976 le nombre des planteurs de tabac a diminué de 80 %, bien que le prix du tabac séché ait augmenté de 110 %.

tobacco products, containing domestic tobacco, are the same as for goods containing imported tobacco exclusively.

The average agricultural acreage of all Austrian farmers in 1973 was 7.8 ha while the average tobacco acreage was only 0.37 ha, corresponding to 4.7 %, although on some farms the tobacco acreage was as high as 40 %.

We have concluded that mechanization in all its phases is needed for the survival of tobacco production in our country. This conclusion is based on a pilot survey over a 3-year period of production costs for a group of farms. But even though mechanization is quite feasible, it is hindered by insufficient funds and increase in overall cost.

Tobacco growing on farms depending mainly on hand labor does not really cover the costs, the manpower input being too high. But for many small land owners there is no possibility to switch to other types of profitable farming or to other occupations.

The average manpower input in 1973 (22 farms) reached 107 h/100 kg farm-weight tobacco and in 1974 (11 farms) 95.8 h.

In selected farms, partially or fully mechanized, it is possible to lower labor input to 60 h. (well organized farm) ; to 44 h (combined stalk cutting) and to 24.4 h (mechanized farm : machine for transplanting, self-propelled semi-automatical harvester, palettes for transport, sewing machine, electric lifting of sticks in special barn).

A106 MILLER R.H.

United States tobacco : Recent and prospective quality changes.

USDA Economic Res. Service, Washington D.C., USA.

Government program changes and price-cost considerations have caused U.S. tobacco growers to make a number of shifts that affect tobacco quality. Weather changes are also summarized where year-to-year quality has varied. Since flue-cured and Burley control programs switched to poundage basis, yields have stabilized. Before 1965 when Federal quotas were on an acreage basis, yields were increasing 4 percent annually. During

Pour le tabac indigène il n'y a ni droits protecteurs ni primes pour l'acheteur et les impôts sur les produits sont les mêmes que ceux pour le tabac importé.

La SAU moyenne de tous les planteurs en 1973 était de 7,8 ha et la surface tabacole moyenne de 0,37 ha, soit 4,7 % de la SAU. Dans des exploitations particulières elle s'élève à 40 %.

D'une enquête triennale sur les frais de production du tabac, il ressort que la mécanisation de toutes les phases de la production est une question vitale. Mais la mécanisation, aujourd'hui absolument possible, est freinée par la situation économique précaire et par l'inflation.

Dans des exploitations, caractérisées par le travail manuel, le maintien de la culture du tabac ne semble pas être rentable, les dépenses de main-d'œuvre étant trop élevées. Mais le propriétaire n'a aucune possibilité de changer la structure de son exploitation dans le sens d'un système plus profitable ou de chercher un autre métier.

Les temps moyens de main-d'œuvre en 1973 (22 exploitations) s'élèvent à 107 h par 100 kg de tabac sec et en 1974 à 95,8 h.

Dans des exploitations choisies, plus ou moins mécanisées, il a été possible d'abaisser les heures de travail manuel à 60 (exploitation bien organisée) ; à 44 h (récolte en tige combinée) et à 24,4 h par 100 kg de tabac séché (exploitation mécanisée : machine planteuse, machine à récolter semi-automatique, palettes pour le transport, machine à coudre les feuilles, élévateur électrique dans le séchoir spécial).

A106 MILLER R.H.

(En anglais) Le tabac aux USA : modifications récentes et à venir en ce qui concerne la qualité.

USDA Economic Res. Service, Washington D.C., USA.

Les modifications du programme gouvernemental et les considérations prix-coûts ont poussé les planteurs US à certains changements agronomiques et technologiques qui affectent la qualité du tabac. On résume également les données météorologiques là où il y a eu variation annuelle de la qualité. Depuis que les programmes de contrôle pour le flue-cured et le burley se fondent sur le poids, les rendements se sont stabilisés. Avant 1965,

1960-64 growers sold 11.4 percent of flue-cured tobacco as grades 1, 2, or 3, while by 1970-74 this share had risen to 17.4. Beginning with the 1970 crop, growers were required to certify they did not use certain pesticides in tobacco. This requirement has reduced residues for those kinds to negligible amounts. Last season the wages U.S. growers paid laborers had risen 130 percent over 1964. Average prices to growers rose only 72 percent in the same period. As a result, growers have made numerous shifts to reduce labor requirements. Number of primings and the amount of farm handling and grading have been reduced. Processors report increasing quantities of sand and other foreign matter have to be removed during redrying prior to packing. Burley growers sold 41 percent of their crop in the mixed category in 1974. This share declined in the 1975 season. Future changes are indicated due to mechanized harvest (flue-cured) and looseleaf sales (Burley). Exporter preference for upper stalk grades and lack of interest in mixed stalk positions has held back the acceptance of once-over harvesters (flue-cured). Other machines continue to expand in importance. Limited sales of loose-leaf (untied) Burley began in 1975 (75- and 80- pound bales). Substantial expansion of these sales requires USDA to change the grade requirements.

lorsque les quotas fédéraux étaient basés sur la superficie, les rendements augmentaient de 4 % par an. Au cours des années 1960–64, les planteurs ont vendu 11,4 % de leur flue-cured dans les classes 1, 2 ou 3, tandis qu'en 1970–74, cette part est passée à 17,4 %. A partir de la récolte de 1970, les planteurs ont dû certifier qu'ils n'utilisaient pas certains pesticides sur le tabac. Les résidus de ces produits ont été réduits à des quantités négligeables. Lors de la dernière campagne, les salaires payés par les planteurs à leur main-d'œuvre ont été 130 % plus élevés qu'en 1964, alors que, pendant la même période, les prix moyens payés aux planteurs n'ont augmenté que de 72 %. En conséquence, les planteurs ont dû adopter de nombreux changements pour réduire leurs besoins de main-d'œuvre. On a réduit le nombre de cueillettes ainsi que les manutentions à la ferme et lors du gradage. Les transformateurs signalent des quantités croissantes de sable et autre matières indésirables, qu'il faut éliminer avant le re-séchage et l'emballage. Les planteurs de burley ont vendu 41 % de leur récolte dans la catégorie mixte en 1974. Cette part a décliné en 1975. De futurs changements sont indiqués, liés à la récolte mécanisée (flue-cured) et à la vente en vrac (burley). La préférence des exportateurs pour les étages foliaires supérieurs et leur manque d'intérêt pour les positions médianes a freiné l'adoption des machines de récolte en une seule fois (flue-cured). D'autres machines prennent de l'importance. Des ventes limitées de feuilles de burley non manoquées ont commencé en 1975 en balles de 30-40 kg. Une expansion substantielle de ce type de vente suppose une modification des prescriptions de gradage de l'USDA.

A107 AHMAD M.

Multitude of tobacco types in Pakistan : present usage and future trends.

Pakistan Tobacco Co., N.W.F.P., Pakistan.

A107 AHMAD M.

(En anglais) Les différents types de tabacs au Pakistan et les prévisions pour sa consommation.

Pakistan Tobacco Co., N.W.F.P., Pakistan.

Tobacco consumption is increasing unhampered by socio-religious taboos or health fright, at 8 % per annum. Varieties of *N. tabacum* and *N. rustica* of Pakistan differ in physico-chemical attributes giving variations in nicotine (0.5 to 7 %) reducing sugars (0 to 22 %), tars, leaf size and texture. Tobacco is consumed in cigarettes (70 million lbs),

La consommation de tabac augmente, nonobstant les tabous religieux ou les craintes pour la santé, d'environ 8 % par an.
Différentes variétés existent : la composition varie dans le pourcentage de nicotine (0,5 à 7 %), de sucre. La taille des feuilles diffère ainsi que la texture.
Le tabac est consommé sous forme de cigaret-

hubble-bubble (65 million lbs), snuff (6 million lbs), chewing (5 million lbs) and bidis (1 million lbs). Rustica constitutes 40 % of tobacco used in cigarettes. Pakistan's cheap high nicotine Rusticas are usable in reconstituted sheets and for nicotine extraction. Rustica cultivars vary in nicotine, sugars and tars. Sun-curing produces creamish white leaf high in sugars. Heavy fertilization and severe fermentation gives dark sugarless leaf high in nicotine. Rustica tobaccos are ideal additives for synthetic smoking materials. Cigarettes consumption shall increase at 8 % per annum initially and then 10 % from 1978 onwards. Consumption in hubble-bubble, chewing, snuff and bidis is declining at 5 % per annum. Exports are expected to rise with Rustica forming greater proportion and filter brands to increase to 40 % in 1980. Sophistication as hinge-lid, crush proof packing etc., shall constitute 20 % of brands by 1980. Mentholated cigarettes are in offing. Female segment of smoking population shall remain small despite advertisement efforts constituting 8 % by 1980. Raw tobacco prices shall not increase in proportion to inflation and shall stay the cheapest. Government revenue to increase to Rs. 1,200 million in 1980. Rationalization of cigarette excise would create brands of equall or similar price category, narrowing the present unrealistic price variations. Unrestricted advertisement holiday shall continue without the fear of health lobby. Smoking-health controversy will not obtain official or institutional support.

tes (70 millions lbs), fumeurs de narguileh (65 millions lbs), ou encore en le prisant (6 millions lbs) ou en le chiquant (5 millions lbs).
40 % du tabac est utilisé pour les cigarettes. Le Pakistan est riche en différentes variétés de tabac.
La consommation de cigarettes augmentera d'abord de 8 % par an, puis de 10 % à partir de 1978. Par contre, les autres formes de consommation diminueront. Les qualités supérieures augmenteront de 40 % en 1980. Les paquets de luxe constitueront 20 % des variétés en 1980.
Les cigarettes mentholées commencent à apparaître. La consommation par la population féminine augmentera seulement de 8 % en 1980. Les prix du tabac brut n'augmenteront pas en proportion de l'inflation générale et resteront meilleur marché. Les revenus du gouvernement augmenteront : 1 200 millions de roupies en 1980. La publicité continue sans crainte pour la santé. La controverse n'a ici aucune realité et les partisans de la lutte anti-tabac ne recevront ici aucun support.

SECTION A2

Herbicides, Residue and Growth Regulation

Herbicides, Résidus et Régulation de Croissance

Chairman — Président

A. DE BAETS

A201 VARDABASSO A.

Trials on Burley tobacco weeds control.

Ist. Sperim. Tab., Scafati, Italy.

The following herbicides were tested in 1974 to protect Burley in a light soil, applying

A201 VARDABASSO A.

(En anglais) Essais de lutte contre les mauvaises herbes sur le tabac burley.

Ist. Sperim. Tab., Scafati, Italy.

Au cours de l'année 1974, des essais avec des herbicides sur le tabac burley en sol léger ont

these one or two days before transplanting : Metobromuron (1.5 kg active ingredient (a.i.)/ha), Butralin (3.0 kg a.i./ha), Diphenamid + Butylate (2.5 kg and 3.3 kg a.i. respectively/ha), Benfluralin (1.6 kg a.i./ha), Napropamid (4.0 kg a.i./ha) and Diphenamid + Napropamid (2.5 kg and 1.5 kg a.i. respectively/ha). The principal spontaneous flora were *Mercurialis annua*, *Chenopodium album*, *Cyperus rotundus*, *Echinochloa crus-galli*. To control weeds in tobacco, the best results were obtained with Napropamid (4.0 kg a.i./ha). None of the herbicides was active against *Cyperus rotundus*.

Glyphosate at different doses on grown weeds was employed 22 days after tobacco transplanting. The two lower doses (0.6 and 1.0 kg a.i./ha) were effective against weeds to protect tobacco.

In 1975 Penoxalin (1.3 and 1.9 kg a.i./ha) and Benfluralin (1.6 kg a.i./ha) were employed one day before transplanting ; the first one on the surface and the second one incorporated in the soil. The spontaneous flora, less prevalent than in 1974, consisted principally of *Cyperus rotundus*, *Amaranthus retroflexus*, *Echinochloa crus-galli*, *Mercurialis annua*.

Results were satisfactory except with *Cyperus rotundus*. But 25 days after transplanting a second treatment using granular Optam (3.7 kg a.i./ha), gave excellent control.

été effectués avec les produits suivants, appliqués un ou deux jours avant la transplantation : métobromuron (1,5 kg m.a./ha), Butraline (3,0 kg m.a./ha), diménamide + Butylate (2,5 + 3,3 kg m.a./ha), Benfluraline (1,6 kg m.a./ha), napropamide (4,0 kg m.a./ha), diménamide + napropamide (2,5 + 1,5 kg m.a./ha).

La flore spontanée consistait principalement en *Mercurialis annua*, *Chenopodium album*, *Cyperus rotundus*, *Echinochloa crus-galli*.

Les meilleurs résultats ont été obtenus avec napropamide (4,0 kg m.a./ha), qui s'est avéré sélectif pour le tabac. Tous les autres produits n'ont montré aucun effet contre *Cyperus rotundus*.

Du glyphosate à différentes doses a été employé sur les mauvaises herbes poussées 22 jours après la transplantation du tabac. Les deux plus petites doses (0,6 et 1,0 kg m.a./ha) se sont avérées efficaces contre les mauvaises herbes et sélectives pour le tabac.

En 1975, du pénoxalin (1,3 et 1,9 kg m.a./ha) et de la Benfluraline (1,6 kg m.a./ha) ont été employés un jour avant la transplantation : le premier produit à la surface et le second incorporé dans le sol.

La flore spontanée, moins importante qu'en 1974, consistait principalement en *Cyperus rotundus*, *Amaranthus retroflexus*, *Echinochloa crus-galli*, *Mercurialis annua*.

Les produits ont été sélectifs pour le tabac et efficaces, à différents degrés, contre les mauvaises herbes, à l'exception toutefois de *Cyperus rotundus*. C'est pourquoi, un second traitement a été effectué sur les mêmes lots, 25 jours après la transplantation, avec de l'Optam (3,7 kg m.a./ha), en granulés, qui a donné d'excellents résultats jusqu'à la récolte, sans présenter d'effet phytotoxique sur les plantes de tabac.

A202 PUZZILLI M.

The prevention of herbicide damage to tobacco.

Ist. Sperim. Tab., Borolone, Italy.

Grosafe, a special active charcoal was tested as means of removing harmful pesticides in soil to protect crops.

Experiments were conducted in a fine, silty-sandy soil, arranged in a split plot design, of which main plots were treated before transplanting with Metobromuron (1.5 kg/ha),

A202 PUZZILLI M.

(En anglais) Prévention des dommages par herbicides en tabac.

Ist. Sperim. Tab., Borolone, Italy.

Grosafe, charbon actif spécial, contenant des substances coadjuvantes, exerce un pouvoir absorbant physique dans le sol pour éliminer la disponibilité biologique des pesticides nuisibles et, par conséquent, pour défendre les cultures.

En sol limono-sableux fin, il a été effectué un

Diphenamid + Butylate (2.5 + 3.271 kg/ha), Diphenamid + Eptam (2.5 + 3.750 kg/ha) and Monolinuron + Linuron (0.3 + 0.5 kg/ha) and comparing them with hoeing. Just before transplanting, tobacco roots of one subplot were dipped in a Grosafe suspension (0.3 kg in 1.5 l of water) ; this treatment was excluded from the other one. In every block an unweeded plot was included.
Herbicidal action was excellent.
Grosafe made the Monolinuron-Linuron mixture well tolerable, reducing the phytotoxicity, following EWRS scale, from 7.8 to 3.5 and the plant losses from 67.3 to 0 %, and increased the yield of cured leaves from 962 to 2,289 kg/ha. The charcoal was effective also with Metobromuron (corresponding action : from 4.3 to 2.4 ; from 32.8 to 0 % ; from 1,722 to 2,220 kg/ha) and at lower degree with Diphenamid + Eptam mixture (corresponding action : from 7.6 to 5.9, value still high ; from 42 to 3.6 % ; from 1,694 to 2,037 kg/ha with a little difference over the significance limit ; beside the topping was late). In this latter case Diphenamid phytotoxicity is excluded and the relation between acetamide and Grosafe should be assessed.
With the selective Diphenamid-Butylate mixture no influence of the protective treatment was noted, as well as in the hoed subplot, where, hence, plant nutrition was normal.
The research will be continued.

A 203 LLANOS M.C., ORTIZ M.R.

Fungicide residues on tobacco leaves and influence on its development of some after-crop treatments.

Servicio Nac. Tab., Sevilla, Spain.

The influence of agricultural fungicide residues on industrial products of tobacco is of major importance from the commercial and sanitary point of view.
Two products commonly used on agricultural practice for cryptogamic disease control in the farm are sprayed. The active material is the

essai à parcelles subdivisées avec parcelles entières désherbées en pré-repiquage, avec Métobromuron (1,5 kg/ha), difénamide + Bûtylate (2,5 + 3,271 kg/ha), difénamide + Eptam (2,5 + 3,750 kg/ha) et monolinuron + linuron (0,3 + 0,5 kg/ha) et en comparaison avec le sarclage. Dans une sub-parcelle, les racines du tabac, juste avant le repiquage, ont été trempées dans une dispersion de Grosafe (0,3 kg dans 1,5 l d'eau), traitement exclus dans l'autre. Dans chaque bloc on a introduit un témoin sans désherbage.
L'action herbicide a été excellente.
Le Grosafe rend tolérable le mélange monolinuron + linuron (réduction de la phytotoxicité, selon l'échelle EWRS, de 7,8 à 3,5 et des manquants de 67,3 à 0 %) ; il augmente la production des feuilles séchées de 962 à 2 289 kg/ha.
Le même produit a été efficace aussi avec le métobromuron (action correspondante : de 4,3 à 2,4 ; de 32,8 à 0 % ; de 1 722 à 2 220 kg/ha) et, dans une moindre mesure, le mélange difénamide + Eptam (action correpondante : de 7,6 à 5,9, valeur encore élévée ; de 42 à 3,6 % ; de 1 694 à 2 037 kg/ha), avec des différences peu supérieures à la limite de signification. En ce dernier cas il faut exclure la phytotoxicité du difénamide, et la relation entre l'acétamide, qui a causé aussi un écimage retardé, et Grosafe devra être tirée au clair.
Avec le mélange sélectif de difénamide + Bûtylate, on n'a noté aucune influence du traitement protecteur non plus que chez le témoin sarclé, où, par conséquent, la nutrition des plantes a été normale.
La recherche se poursuit.

A203 LLANOS M.C., ORTIZ M.R.

(En anglais) Résidus de fongicides sur les feuilles du tabac et influence, au cours de leur développement, de quelques traitements après récolte.

Servicio Nac. Tab., Sevilla, Spain.

L'influence qu'ont les résidus de fongicides employés en champ sur la qualité des produits industriels de tabac est du plus grand intérêt du point de vue commercial et sanitaire.
Dans les plantations de tabac, et pour la lutte contre plusieurs maladies cryptogamiques, on emploie, en pulvérisation, deux produits

zinc ethylene-bis-dithiocarbamate. The dosage and method of application are those commonly used in fully developed farms. The treatment season is 1 month prior to harvesting.

Treated tobacco is cured by hanging whole plants inside a barn equipped with a vertical air stream system. This curing process has been the most commonly used. Once the tobacco is taken down, the lower, middle and sand leaves are primed to be subjected to a natural fermentation process in a place with controlled humidity and temperature.

During fermentation the normal condition of temperature and humidity used in the natural and forced fermentation chambers will be duplicated.

The tobacco will be primed and fermented under two requirements : a normal one and a high pressure one.

After fermenting fungicide residues on the leaves will be analyzed, using the revised CORESTA method.

courants en agriculture. La matière active est l'éthylène-bis-dithiocarbamate de zinc. Les doses et la méthode d'application sont celles en usage dans les plantations. Le traitement doit commencer un mois avant la récolte. Le séchage du tabac traité est réalisé en pendant les plantes entières dans un séchoir à tirage vertical. Le procédé de séchage a été le procédé courant. Quand le tabac est décroché, les feuilles basses, médianes et plus basses sont détachées de leur tige, elles sont ensuite soumises à un processus de fermentation naturelle dans un milieu contrôlé.

Au cours de la fermentation, on reproduit les conditions de température et d'humidité employées dans les chambres de fermentation forcée.

Le tabac en feuilles est fermenté sous 2 conditions de pression : une normale, et l'autre élevée.

Après la fermentation, on analyse les résidus de fongicides qui restent sur les feuilles (méthode révisée CORESTA-juin 1974).

A204 CHOPRA N.M., MAHFOUZ A.M.

Metabolism of Endosulfan I, Endosulfan II, and Endosulfan sulfate in tobacco leaf.

North Carolina Agric. Tech. State Univ., Greensboro, USA

Tobacco plants were separately treated on July 30, 1973 with 0.75 lb/acre and 1.5 lbs/acre of Endosulfan I, II and sulfate. Leaves from these treatments were harvested 5, 14 and 24 days later and analyzed for metabolites. Endosulfan I, Endosulfan sulfate, Endosulfan diol, Endosulfan ether, and Endosulfan lactone were found in the leaves of all the treatments. However, Endosulfan II was found only in Endosulfan I and II treated leaves. Thus, in tobacco leaf, Endosulfan I and II are interconvertible ; Endosulfan sulfate is converted into Endosulfan I but not into Endosulfan II ; and Endosulfan I, II and sulfate can directly hydrolyze into Endosulfan diol. Based on these researches we have proposed a new pathway for the metabolism of Endosulfan in tobacco leaf.

A204 CHOPRA N.M., MAHFOUZ A.M.

(En anglais) Métabolisme de l'endosulfan I, l'endosulfan II et l'endosulfan sulfate dans la feuille de tabac.

North Carolina Agric. Tech. State Univ., Greensboro, USA.

Le 30 juillet 1973, des plants de tabac ont été séparément traités avec de l'endosulfan I, II et sulfate à raison de 0,85 kg/ha et de 1,7 kg/ha. Les feuilles, ayant subi ces traitements, ont été récoltées 5, 14 et 24 jours plus tard et on en a analysé les métabolites. Dans les feuilles de tous les traitements, on a trouvé de l'endosulfan I, de l'endosulfan sulfate, de l'endosulfan diol, de l'endosulfan éther et de l'endosulfan lactone. Toutefois, l'endosulfan II n'a été trouvé que dans les feuilles ayant été traitées par l'endosulfan I et II. Par conséquent, dans les feuilles de tabac, l'endosulfan I et II sont interconvertibles ; l'endosulfan sulfate est converti en endosulfan I, mais pas en endosulfan II, et l'endosulfan I, II et sulfate peuvent directement s'hydrolyser en endosulfan diol. En nous basant sur ces recherches, nous proposons une nouvelle voie pour expliquer le métabolisme de l'endosulfan dans la feuille de tabac.

A205 DAVIS D.L., ATKINSON W.O.

Maleic hydrazide levels during maturation and curing of Burley tobacco.

Dept. Agron., Univ. Kentucky, Lexington, USA.

Maleic hydrazide (1,2-dihydropyridazine-3,6-dione) is the only systemic compound presently used for controlling axillary bud development in air-cured Burley tobacco. The leaf residues of this compound were determined over the period of time from immediately after application to topped field grown tobacco until the tobacco was cured by conventional methods. Sample residue analysis was accomplished by using a slightly modified AOAC procedure. Maleic hydrazide was translocated rapidly to the lower leaves as residue levels changed from 0 to 100 μg/g dry weight 24 hours after treatment. Residue levels of 300 μg/g dry weight were found for the upper portions of the plant to which the sucker control agent had been directly applied. There was a rapid reduction in residue levels in the upper leaves during the first 7 days after application, followed by a gradual reduction for the total plant during final maturation and air-curing on the stalk to levels of 20 to 150 μg/g dry weight depending upon the particular dosage, location of the leaves on the plants and tobacco variety. ^{14}C labeled maleic hydrazide was used to examine the uptake and translocation under controlled environmental conditions. Increases in relative humidity from 75 to 100 % increased the absorption of maleic hydrazide and resulted in higher recovery from the stem and root of the plant. Practical methods for reduction of maleic hydrazide residues on tobacco will be discussed.

A205 DAVIS D.L., ATKINSON W.O.

(En anglais) Les niveaux d'hydrazide maléique au cours de la maturation et du séchage du tabac burley.

Dept. Agron., Univ. Kentucky, Lexington, USA.

L'hydrazide maléique (1,2-dihydropyridazine-3,6-dione) est le seul composé assimilable actuellement utilisé pour la prévention de la formation de drageons dans le tabac burley séché à l'air. Les résidus de ce composé, dans les feuilles, ont été déterminés à partir du moment qui a suivi son application sur le tabac écimé (cultivé en champ), jusqu'au séchage par les méthodes classiques.
Pour faire l'analyse d'un échantillon de résidu, on a suivi la méthode AOAC légèrement modifiée. On a constaté, 24 heures après l'application, un rapide transfert de l'hydrazide maléique vers les feuilles du bas de la plante et des variations de niveaux de résidus allant de 0 à 100 μg/g poids sec. (On a enregistré des niveaux de résidus de 300 μg/g poids sec). Dans les parties supérieures de la plante qui avaient été directement soumises à l'agent inhibiteur. On a observé une diminution rapide des niveaux de résidus dans les feuilles du haut de la plante pendant les sept premiers jours qui ont suivi l'application, suivie par une diminution progressive pour l'ensemble de la plante au cours de la maturation finale et du séchage sur tige, de 20 à 150 μg/g poids sec selon les dosages spécifiques, la position des feuilles sur les plantes et la variété de tabac. On a utilisé l'hydrazide maléique ^{14}C pour déterminer l'absorption et le transfert en milieu contrôlé. Des augmentations d'humidité relative de 75 % à 100 % ont accru l'absorption d'hydrazide et permis une meilleure récupération à partir de la tige et des racines de la plante. Nous présenterons quelques méthodes pratiques pour obtenir une diminution des résidus d'hydrazide maléique dans le tabac.

A206 MOORE E.L.

Modifying tobacco growth with chemicals.

USDA, Agric. Res. Service, Beltsville, USA.

Research on tobacco growth regulating chemicals is both applied and basic. ARS cooperates

A206 MOORE E.L.

(En anglais) Modification de la croissance du tabac à l'aide de produits chimiques.

USDA, Agric. Res. Service, Beltsville, USA.

La recherche concernant la régulation de la croissance du tabac par des produits chimiques

with State agricultural experiment stations and the tobacco and chemical industries in the search for chemicals that leave minimal residues. Chemical sucker control is emphasized, but some attention has also been given to disbudding or topping, ripening, and control of flowering. Several thousand chemicals have been screened, and on the average 10-15 new chemicals are evaluated each year. The chemicals are screened for efficacy and phytotoxicity, progressing from tests on greenhouse plants to preliminary and regional advanced field tests. In addition, field and laboratory evaluations include physical, chemical, and smoke quality determinations on cured leaf. Chemicals have been identified that kill suckers and young terminal flower buds on contact. Those that kill terminal flower buds decapitate the plant. In addition, some hasten yellowing and ripening of mature leaves in the field. Others retard temporarily the growth of tobacco seedlings, thus permitting better planning of the transplanting operation.

The basic phase of tobacco growth regulator research is part of a larger program pertinent to all plants. The research involves the isolation, identification, and characterization of natural products that regulate tobacco plant growth. Sources of these chemicals include some insects and fungi, the tobacco plant, and a broad range of other plants from many parts of the world. Some of these plants are potential sources of anti-tumor drugs for treating cancer in man as well as potential sources of tobacco growth modifiers.

A207 CUTLER H.G., COLE R.J., WELLS J.M.

New naturally occurring plant growth regulators : Potential use in tobacco culture.

Agric. Res. Service, USDA, Tifton, USA.

Tobacco seedlings, grown under short days and cool nights, were treated when six weeks old with Cytochalasin H which inhibited growth 87, 81 and 53 % with 10^{-2}, 10^{-3} and

est à la fois appliquée et fondamentale. Le service de recherche agronomique des USA (ARS) coopère avec les centres d'expérimentation agricole d'Etat ainsi qu'avec les industries tabacoles et chimiques pour trouver des substances laissant un minimum de résidus. On insiste sur l'ébourgeonnement chimique mais on porte également attention à l'ébourgeonnement manuel ou à l'écimage, à la maturation ainsi qu'au contrôle de la floraison. Plusieurs milliers de substances ont été triées et 10 à 15 nouveaux produits en moyenne sont examinés chaque année. Les critères de sélection sont l'efficacité et la phytotoxicité, et s'exercent à partir des essais en serre jusqu'aux essais régionaux en champ, à un stade primaire ou avancé. Les examens en champ et en laboratoire comportent en outre des déterminations physiques, chimiques et organoleptiques de la feuille séchée. On a identifié des produits chimiques qui détruisent les bourgeons de pousses et les jeunes bourgeons floraux par contact. Ceux qui détruisent les bourgeons floraux décapitent la plante. De plus, certains accélèrent le jaunissement et la maturation des feuilles dans le champ. D'autres retardent provisoirement la croissance des plantules de tabac, permettant une meilleure planification des opérations de transplantation.

L'aspect fondamental de la recherche sur les régulateurs de croissance du tabac fait partie d'un programme plus vaste s'appliquant à toutes les plantes. Cette recherche comporte l'isolement, l'identification et la caractérisation des produits naturels qui régulent la croissance de la plante de tabac. Parmi les sources naturelles de ces substances, il y a certains insectes et champignons, le tabac lui-même et une large gamme d'autres plantes de toutes les régions du monde. Certaines d'entre elles sont une source potentielle de médicaments anti-tumoraux pour traiter le cancer chez l'homme ainsi que d'agents régulateurs de la croissance du tabac.

A207 CUTLER H.G., COLE R.J., WELLS J.M.

(En anglais) Nouveaux régulateurs de croissance naturels : une possibilité d'application dans la culture du tabac.

Agric. Res. Service, USDA, Tifton, USA.

Les plants de tabac poussés en un court laps de temps et au cours de nuits froides ont été traités pendant six semaines à la Cytochalasine H qui fait obstacle à la croissance dans une

10^{-4} M applications 29 days after treatment. Consequently, at 43 days after application, controls were in full bloom, treatments at 10^{-4} M were at incipient corolla opening, 10^{-3} M treatments were at early button stage and 10^{-2} M treatments were still vegetative.

Moniliformin (K salt of 1-hydroxycyclobut-1-ene-3,4-dione) significantly inhibited tobacco seedling growth when added at 10^{-2} and 10^{-3} M in greenhouse tests. Field trials indicated that Moniliformin inhibited axillary shoot growth of mature topped tobacco plants when applied at 100 mg, or 10 mg, per plant and at 12 days after treatment it competed well with MH-30. At 21 days, suckers were harvested and weighed. Yields of suckers (axillary shoots) expressed as ratios of MH-30 : Moniliformin : Control, were 1 : 2 : 7.

Other natural products, including Oosporein and Brefeldin A will be discussed for potential use in tobacco culture.

proportion de 87, 81 et 53 % avec applications de 10^{-2}, 10^{-3}, 10^{-4} *M* 29 jours après traitement. Ainsi après 43 jours d'application, les éléments sous contrôle étaient en pleine floraison, les éléments traités à 10^{-4} *M* en phase d'ouverture de la corolle, ceux à 10^{-3} *M* en boutons et enfin ceux à 10^{-2} *M*, toujours en phase végétative.

La moniliformine (sel K de 1-hydroxycyclobut-1-ene-3,4-dione) réduit considérablement la croissance des plants de tabac lorsqu'elle est mélangée dans la proportion de 10^{-2} et 10^{-3}*M* au cours d'essais en serre. Les essais sur plantation révèlent que la moniliformine réduit la croissance des pousses axillaires des plantes de tabac écimées, parvenues à maturité, si elle est appliquée dans la proportion de 100 mg, ou 10 mg par plante ; 12 jours après application, elle est compétitive avec MH-30. Les surgeons sont récoltés et pesés au 21ème jour. Le rendement de surgeon (pousses axilliaires) exprimé en rapport MH-30 : moniliformine : témoin est de 1 : 2 : 7.

D'autres produits naturels, y compris l'oosporéine et la Brefeldine A feront l'objet de débats ultérieurs pour leur éventuelle application dans le domaine de la culture du tabac.

SECTION A3

Culture, Quality and Physiology

Culture, Qualité et Physiologie

Chairman — Président

I. McDONALD

A301 MATUSIEWICZ E.

Effects of phosphorus on the development, yields and quality of tobacco.

Poznań Agric. College, Poznań, Poland.

A number of experiments, performed on tobacco feeding with phosphorus, made it possible to make observations and notes on the role of this fertilizer in the wide-scaled production of tobacco. Experiments with flue-

A301 MATUSIEWICZ E.

(En anglais) Influence du phosphore sur le développement, les récoltes et la qualité du tabac.

Poznań Agric. College, Poznań, Poland.

De nombreux essais concernant la nutrition en phosphore du tabac ont donné l'occasion d'observer le rôle de cet engrais dans la production du tabac. Les essais avec le tabac jaune ont été effectués principalement en pots, avec

cured cigarette tobacco have been mainly performed in pots at a greenhouse on various soils, characterized by a great range of reactions, different water capacity, richness in plant nutrients and containing sometimes extremely little P_2O_5, i.e. below 1 mg/100 g of soil. These experiments have provided abundant evidences of the tremendous role of phosphorus in the development of tobacco plants.

Phosphorus applied in rich dosages had a positive influence on the growth of stems and the size of leaves, accelerated the development of buds and flowering, increased the leaf yields and improved their quality. Tobacco, heavily fertilized with phosphorus, had the dominant yellow-gold color of leaves and a denser leaf tissue.

Numerous chemical analyses of leaves have displayed a positive effect of phosphorus on their qualitative composition. Larger dosages decreased the content of protein substances and at the same time strongly increased the content of carbohydrates. Increased dosages of phosphorus resulted, as a rule, in a considerable reduction of the alkaloid percentage in leaves. Important is also the fact that phosphorus was a factor in reducing the detrimental effect of increased usage of nitrogen fertilizer, applied with the aim to increase yield of crops.

These experiments indicate that in order to obtain tobacco crops of good yield and quality, heavy fertilization with phosphorus is necessary.

A302 BENVENUTI A., MARCELLI E., TUMMINELLO M., MIELE S., BEUCHAT A.

Fertilization trial of Maryland tobacco with anhydrous ammonia.

Universita di Pisa, Pisa, Italy.

The aim of this work was to compare anhydrous ammonia fertilization of Italian tobacco with traditional nitrogen fertilization and to determine whether the ammonia could be applied before transplanting to save the expense of cover applications.

The trial was carried out in Umbria (Central Italy), near Orvieto on Maryland tobacco which requires more nitrogen as compared to other Italian varieties. The following appli-

emploi de divers sols qui se distinguaient entre eux par le pH, par la capacité capillaire et par la richesse en éléments nutritifs, celle-ci comportant parfois moins d'un mg de P_2O_5 dans 100 g de sol. Ces essais ont fourni un matériel très abondant, témoignant du rôle marquant du phosphore dans la formation de la plante de tabac.

De fortes doses de phosphore favorisent la croissance des tiges et la grandeur des feuilles, accélèrent le bourgeonnement et la floraison, influent sur l'augmentation des récoltes de feuilles et l'amélioration de leur qualité. Les feuilles de tabac fertilisé abondamment avec du phosphore ont une couleur jaune-dorée, et le tissu des feuilles est plus compact.

De nombreuses analyses chimiques des feuilles témoignent de l'influence positive du phosphore sur leur qualité. Les doses plus fortes contribuent à diminuer la teneur en substances protidiques, tout en augmentant considérablement la teneur en hydrates de carbone. L'accroissement des doses de phosphore conduit généralement à abaisser sensiblement le pourcentage d'alcaloïdes dans les feuilles. Non moins important le fait que le phosphore est un facteur annihilant l'effet négatif qu'exercent sur la qualité des feuilles les doses croissantes de fertilisation nitrique, administrées en vue de l'accroissement des récoltes.

Les résultats des essais mentionnés ci-dessus conduisent à une conclusion de caractère général, à savoir : pour obtenir de bons résultats dans la culture de tabac, tant au point de vue quantité que qualité, une abondante fertilisation en phosphore est indispensable.

A302 BENVENUTI A., MARCELLI E., TUMMINELLO M., MIELE S., BEUCHAT A.

(En anglais) Essai de fertilisation du tabac Maryland avec de l'ammoniaque anhydre.

Universita di Pisa, Pisa, Italy.

Le but de cette étude était d'étudier la réaction du tabac aux applications d'ammoniaque anhydre, en la comparant aux fertilisants azotés traditionnels, et d'étudier la possibilité d'appliquer tout l'azote avant la transplantation, de façon à économiser le coût des applications de couverture.

Ces essais ont été mis en place en Ombrie (Italie centrale), près d'Orvieto avec du tabac Maryland, qui exige plus d'azote que les autres

cations of fertilizers were used.

Test A N (kg 150) NH_3 before transplanting ;
P_2O_5 (kg 126) superphosphate 20-21 before transplanting ;
K_2O (kg 74) potassium sulphate before transplanting ;

Test B N (kg 84) (56 %) NH_3 before transplanting ;
N (kg 66) (44 %) ammonium nitrate cover application ;
P_2O_5 (kg 126) superphosphate 20-21 before transplanting ;
K_2O (kg 74) potassium sulphate before transplanting ;

Check test : traditional fertilizing rate/ha :
700 kg NPK 12/18/12
250 kg ammonium nitrate

Random block trial with four replicates, anhydrous ammonia injected 15 cm. Plant spacing 90 x 45 cm (2,492 plant/ha). Harvesting and curing was mixed, single leaves for the three first leaves, the whole plant with an average of 26 leaves for the remaining plants.

During the vegetative cycle, it was possible to confirm by direct and macroscopic observations the validity of the findings of US research workers the evolution of NH_3 as a function of temperature and moisture in soil. McDAWELL & SMITH ; McINTOSH, FREDERICH *et al* found that at 15 °C, 60 % of the ammonia injected into the soil is converted into nitrates after 8 weeks, while at 25 °C in the same time about 80 % is transformed. This transformation has been confirmed on tobacco. Due to the local rainy weather conditions the nitrification process of anhydrous ammonia was slowed down in the first part of the vegetative cycle (up to 55 days after transplanting), the plants of Test A had less leaf vegetation of both B and Check tests by the end of July onward (with warmer weather conditions) and inversion of this trend has been observed accompanied with a steady increase of leaves and stem development of Test A compared to the other two tests.

The yield performance has been improved by anhydrous ammonia fertilization ; Test A gave a yield of 3,733 kg/ha, compared to 3,466 kg/ha, Test B and 3,374 kg/ha of the check. Also the leafy quality of the plants of the A test replicates have given better results, the estimated price for the dried leaves of Test A was 1,072.83 lit/kg ; 1,015.66 lit/kg for test B and 837.08 lit/kg for the check. The chemical analysis of tobacco will be presented.

variétés italiennes. L'ammoniaque anhydre a été injectée dans le sol à une profondeur de 15 cm. Au cours du cycle végétatif, il a été possible de confirmer sur les plantes, par observations directes et macroscopiques, la validité des découvertes des chercheurs américains (Mc DAWELL & SMITH, Mc INTOSH, FREDERICH *et al.*) sur l'évolution de NH_3, par rapport à la météorologie et à l'humidité du sol, notamment à une température de 15 °C ; 60 % de l'ammoniaque injecté dans le sol est converti en nitrates après huit semaines, tandis qu'à une température de 25 °C environ 80 % est transformé. Cette transformation a été confirmée sur le tabac : en raison des conditions météorologiques pluvieuses de l'endroit, le processus de nitrification de l'ammoniaque anhydre a été ralenti au cours de la première partie du cycle végétatif (jusqu'à 55 jours après la transplantation) ; le développement des plantes de l'objet A (N sous forme d'ammoniaque anhydre) était inférieur au développement des plantes de l'objet B (ammoniaque anhydre + nitrate d'ammoniaque) et de l'objet de vérification dans des conditions météorologiques plus chaudes (N sous forme de composé) ; une inversion de cette tendance a été observée, accompagnée par une augmentation régulière des feuilles et un développement des tiges des plantes de l'objet A, comparées à celles des deux autres objets. Le rendement a été influencé d'une manière positive par la fertilisation à l'ammoniaque anhydre ; les fertilisants appliqués avant la transplantation (objet A) ont donné un rendement de 3 733 kg/ha, comparés à 3 466 kg/ha (objet B) et 3 374 kg/ha (objet de vérification).

En outre, la qualité des feuilles de l'objet A a enregistré de meilleurs résultats, le prix évalué pour les feuilles séchées de l'objet A étant L.it. 1 072,83/kg ; L.it. 1 015,66/kg pour l'objet B et 837,08 L.it./kg pour l'objet de vérification.

Les résultats de l'analyse chimique des tabacs seront communiqués.

A303 SARAGONI H.

(In French) On the improvement of the burning capacity of the tobacco cultivated in soils with Andept characteristics in Reunion Island.

Inst. Rech. Agron. Tropicales, St. Denis, Ile de la Réunion.

Reunion is a French, tropical and sugar growing island located in the Indian Ocean. The tobacco production is low (150 tons of dark air-cured tobacco in 1975) but has been constantly increasing these last 10 years. Within the framework of a culture diversification policy, it permits the improvement of the profit making capacity of small farms based on a family organization.

Being of a volcanic origin (about 2,000,000 years old), Reunion Island soils are rich in organic matter, clay (from 50 to 70 % of amorphous substances « allophans »), magnesium and often in chlorine. Being low in potassium content, these soils frequently yield tobacco with poor burning properties.

Thanks to the very good structure and permeability ($K = 4 \times 10^{-3}$ cm/sec) of these soils, we can hope to achieve a leaching (with at least 300 mm water within 24 hours) of a part of the chlorine. A very high potassium fertilization before tobacco planting (1,200 K_2O/ha) does not improve its burning capacity. It seems potassium first needs to be fixed. Yet an increase in exchangeable K is possible within a few years (from 0.15 to 0.80 - 1.20 m.e. %).

So the chlorine content in the leaves should decrease from 50-70 to 25 m.e. % and their cationic balance change from 1-5-3 to 2-3-1. Consequently we may expect a tobacco with a better burning capacity will be produced and the yield will be increased (3.0-3.5 t/ha) thanks to an increased nitrogen fertilization.

A303 SARAGONI H.

Considérations sur l'amélioration de la combustibilité du tabac cultivé dans les sols à caractères andiques de la Réunion.

Inst. Rech. Agron. Tropicales, St. Denis, Ile de la Réunion.

La Réunion est une île française, tropicale et sucrière de l'Océan Indien. La production du tabac y est faible (150 tonnes de tabac brun séché à l'air en 1975) mais en constante progression depuis 10 ans. Elle permet, dans le cadre d'une politique de diversification des cultures, l'amélioration de la rentabilité des petites exploitations de type familial.

D'origine volcanique récente (environ 2 000 000 d'années), La Réunion possède des sols à caractères andiques. Riches en matière organique et en argile (dont 50 à 70 % de substances amorphes : « allophanes »), en magnésium et souvent en chlore sur le littoral, mais généralement pauvres en potassium, ces sols donnent fréquemment des tabacs peu combustibles.

Grâce aux très bonnes structure et perméabilité ($K = 4 \times 10^{-3}$ cm/sec) de ces sols, on peu espérer lessiver (au moins 300 mm d'eau en 24 heures) une partie du chlore. Une très forte fertilisation potassique avant tabac (1 200 K_2O/ha) n'améliore pas sa combustibilité. Le potassium semble tout d'abord devoir être fortement fixé. Par contre un enrichissement en K échangeable peut intervenir en quelques années (de 0,15 à 0,80 - 1,20 m.e. %).

On devrait ainsi faire passer la teneur en chlore des feuilles de 50 - 70 à 25 m.e. % et leur équilibre cationique K-Ca-Mg de 1-5-3 à 2-3-1. On peut donc espérer produire un tabac plus combustible et – par une augmentation de la fertilisation azotée – obtenir un rendement inchangé (3,0 - 3,5 t/ha).

A304 BUSH L.P., SIMS J.L., ATKINSON W.O.

Physiology of nitrogen fractions of high and low alkaloid tobacco.

Dept. Agron., Univ. Kentucky, Lexington, USA.

Burley 21 and low alkaloid (LA) Burley 21 tobaccos were developed at the University of Kentucky. These lines have about 4.6 % and

A304 BUSH L.P., SIMS J.L., ATKINSON W.O.

(En anglais) Physiologie des fractions d'azote dans les tabacs à forte et faible teneur en alcaloïdes.

Dept. Agron., Univ. Kentucky, Lexington, USA.

Le tabac Burley 21 et le Burley 21 à faible teneur en alcaloïdes (FA) ont été mis au point à l'Université du Kentucky. Les feuilles séchées à

0.3 % total alkaloids in air-cured leaf, respectively. These lines were compared for accumulation of dry weight and nitrogenous fractions during two seasons from transplanting to cured leaf. There were no differences in dry weight accumulation, nitrate nitrogen or protein content in oven dried leaf tissue of the two lines. Burley 21 had a higher total nitrogen content from 84 days after transplant (early harvest) until termination of the experiment, 108 days after transplant. Total alkaloid content was greater in Burley 21 at all samplings as were the individual alkaloids — nicotine, nornicotine, anabasine and anatabine. The amount of total volatile nitrogenous bases (TVNB) tended to be higher in Burley 21, especially at the later samplings. Non-alkaloid volatile base content was higher in LA Burley 21 at the later harvests. In cured leaf, Burley 21 had greater amounts of alkaloids, TVNB and often greater amounts of total nitrogen and nitrate nitrogen. Cured leaf of LA Burley 21 tended to have more protein and non-alkaloid volatile nitrogenous bases. Our conclusions are that 1. these tobacco lines are very near isogenic for nitrogenous compounds other than alkaloids, 2. the genetic lesion for alkaloid accumulation is in nitrogenous base metabolism, 3. these lines would be very useful for studies on alkaloid biosynthesis and 4. the curing process may alter the nitrogenous compounds differently in these two lines.

A305 ATKINSON W.O., MORRISON J.

No-tillage culture of Burley tobacco.

Dept. Agron. Agric. Engi., Univ. Kentucky, Lexington, USA.

Experimental plantings of no-tillage Burley tobacco have been evaluated over several years in Kentucky. The concept is similar to no-tillage grain production in which herbicides are used to kill existing herbage with the exception that for tobacco culture plants rather than seeds were introduced into the killed herbage. The transplanting operation is made possible by use of a specially designed

l'air de ces deux variétés présentent respectivement un total d'alcaloïdes de 4,6 % et 0,3 %. La comparaison entre ces deux variétés porte sur l'accumulation de poids sec et de fractions azotées pendant deux saisons, du repiquage au séchage des feuilles. On a constaté qu'il n'y a aucune différence d'accumulation de poids sec, de quantité d'azote, de nitrates ou de protéines dans les tissus des feuilles séchées au four. Le Burley 21 contient davantage d'azote entre le 84ème jour après le repiquage (première récolte) et le 108ème jour après le repiquage, jour final de l'expérience. Pour tous les échantillons du Burley 21, on a observé une plus grande quantité d'alcaloïdes en général et des alcaloïdes-nicotine, nornicotine, anabasine et anatabine en particulier. La quantité totale de bases azotées volatiles (TBAV) est plutôt plus élevée dans le Burley 21, surtout dans les derniers échantillons. La teneur en bases volatiles dépourvues d'alcaloïdes est plus élevée dans les échantillons de fin de saison du Burley 21 FA. Les feuilles séchées du Burley 21 contiennent davantage d'alcaloïdes, de TBAV et, souvent, d'azote et de nitrate d'azote. Les feuilles séchées du Burley 21 FA ont tendance à contenir plus de protéines et de bases azotées volatiles dépourvues d'alcaloïdes. Nous concluons que 1) ces deux variétés de tabac sont d'origine quasi identique quant aux composés azotées autres que les alcaloïdes, 2) la lésion génétique pour l'accumulation d'alcaloïdes se situe au niveau du métabolisme des bases azotées : 3) ces deux variétés seraient très utiles dans les recherches sur la biosynthèse des alcaloïdes et 4) il est possible que les procédés de séchage altèrent les composés azotés différemment chez chacune de ces deux variétés.

A305 ATKINSON W.O., MORRISON J.

(En anglais) Culture sans labour du tabac burley.

Dept. Agron. Agric.-Engi., Univ. Kentucky, Lexington, USA.

Des évaluations s'étendant sur plusieurs années ont été réalisées dans l'Etat de Kentucky au sujet du plantage expérimental sans labour du tabac burley. Le concept est analogue à celui de la production de céréales sans labour, dans lequel on utilise des herbicides pour faire disparaître les herbes. Il existe toutefois la différence que, pour la culture du tabac, des plants, et non pas des semences, ont été intro-

transplanter which opens and closes a furrow in thin or dense sods. Benefits from no-tillage culture include the ability to transplant and harvest without being delayed by wet soil and elimination of dirt splashed onto tobacco leaves by rainfall occurring while tobacco is wilting in the field after being cut. Some experimental variables that have been investigated to determine their influence on plant growth are 1. rate and time of application of nitrogen fertilizer, 2. plant size at transplanting, 3. time of transplanting and 4. root-soil contact at transplanting. The survival of Burley tobacco plants in no-tillage plots was lower than in conventional tillage plots. Added fertilizer nitrogen was utilized less efficiently by plants growing under no-tillage culture and was not overcome by addition in two or three applications rather than one preplant application. Plants growing in killed sod developed less extensive root systems which generally resulted in reduced plant growth, smaller leaves and lower yields of cured tobacco.

A306 BERMEJO H.M.

(In French) Economic results of the effects of planting distances on the quality of different varieties of Burley.

Servicio Nac. Tab., Centro Ferment. Tab., Madrid, Espagne.

During 1974-75, tests on planting distances were made under Spanish conditions of nine varieties of Burley (Ky 35, Ex 12PR 8, W.B. PR 10 and Burley M.B. from Spain, the Swiss SOTA 6,505, the French BB-163-bl, and Burley 21, Burley 49 and Ky 12 from the USA) at distances of 100 x 50, 100 x 40, 100 x 35, 80 x 40, 80 x 35, and 70 x 35 cm. The economic results per hectare were calculated for each of the 54 possible combinations.

Factors which were taken into account in one calculation were : sale price of tobacco, yield per hectare, quality, indications of *Perono-*

duits dans les herbages tués par les produits herbicides. Le travail de transplantation a été rendu possible par une machine de conception spéciale capable d'ouvrir et de refermer un sillon dans des couches herbeuses minces ou épaisses. Les avantages de la culture sans labour comprennent le fait de pouvoir transplanter et récolter sans être retardé par l'humidité du terrain, ainsi que l'élimination des projections de boue sur les feuilles de tabac par temps de pluie lorsque les feuilles sont en javelage sur le champ, après avoir été coupées. Certains paramètres expérimentaux ont été étudiés pour déterminer leur influence sur la croissance de la plante. Ce sont : 1) la dose et la date d'application de l'azote, 2) la taille de la plante au moment de la transplantation, 3) la date de la transplantation et 4) le contact racine-sol lors de la transplantation. La survivance des plants de tabac Burley s'est avérée inférieure à celles des plants dans les terrains labourés de façon classique. L'azote ajouté a été utilisé de façon moins efficace par les plantes croissant en culture sans labour et deux ou trois applications de cet engrais sont demeurées inférieures à une seule application avant la plantation. Les plantes poussant dans une couche d'herbage dévitalisé présentent des systèmes racinaires moins développés, ce qui entraine généralement une croissance réduite de la plante, des feuilles plus petites et une récolte inférieure de tabac séché.

A306 BERMEJO H.M.

Influence de la distance de plantation sur la qualité et les résultats économiques de différentes variétés de tabac burley.

Servicio Nac. Tab., Centro Ferment. Tab., Madrid, Espagne.

On a testé en 1974-75, dans les conditions de l'Espagne, la culture de neuf variétés de burley (Ky 35, Ex 12 PR 8, W.B. PR 10, Burley M.B., Sota n° 505, BB-163-b1, Burley 21, Burley 49, et Ky 12) aux distances de plantation suivantes: 100 x 50, 100 x 40, 100 x 35, 80 x 40, 80 x 35 et 70 x 35. Pour chacune des 54 variantes possibles de l'essai on a calculé les rendements/ha, que l'on a comparé à ceux de la variété traditionnelle Ky 35, cultivée à la densité de 25 000 plantes/ha. Les résultats ont été calculés à partir des données suivantes : revenus bruts/ha (augmentant avec la densité), prix au kg (fonction de la qualité, elle-même

spora damage, bonus policies in Spain, leaf position, color, absence of foreign matter, nicotine content, burning properties, labor expense for sowing, planting, topping, suckering, harvesting, transportation, stringing, sorting, tying, baling and other factors.

The profits were reduced by dense planting with Ky 35. PR 8 and SOTA showed the greatest profits at 100 x 50 ; PR 10 at 70 x 35, BB at 100 x 35, Burley 21 at 100 x 40, and Burley M.B. yielded the greatest profits of all (more than 22,751.52 pesetas/ha) at a distance of 80 x 40. The Burley 49 and Ky 12 strains showed the lowest profits because of their vulnerability to *Peronospora*.

The highest quality margins with cured tobacco were : 20.15 % at 80 x 40 for Ky 35, 22.75 % at 100 x 50 for PR 8, 24.2 % at 100 x 50 for PR 10, 24.05 % at 80 x 40 for Burley M.B., 21.65 % for SOTA, 27.03 % at 80 x 35 for BB, 24 % at 80 x 35 for Burley 21, 23.4 % at 100 x 50 for Burley 49, and 23.65 % at 100 x 50 for Ky 12. And by extending the fermentation time (Burley was fermented in Spain), the general increase exceeded 94.87 % at a distance of 100 x 40 for Ky 35, 73.71 % as 100 x 40 for PR 10, 90.09 % at 100 x 35 for Burley M.B., 70.27 % at 100 x 50 for BB, 84.29 % at 100 x 35 for Burley 49 and 50.96 % at 80 x 35 for Ky 12.

A307 JAMES R.W.

The effects of plant spacing and ripeness of leaf at the time of harvest on three flue-cured varieties of tobacco.

Tob. Res. Station, Motueka, New Zealand.

The results of experimental work in flue-cured tobacco have traditionally been reported as significant increases or decreases in yield, grade index, crop index, total nicotine alkaloids, totall sugars, filling values, equilibrium moisture content etc.

influencée par *Peronospora*), primes à la qualite ayant cours en Espagne et qui sont fonction des qualités organoleptiques du tabac (étage foliaire, couleur, état sanitaire, etc.) ainsi que de la teneur en nicotine et de la combustibilité du tabac séché (de 0 à 2,6 % de nicotine et de 2 à 10 secondes de combustibilité, la prime passe de 20 à 65 % du prix des feuilles de première classe), déduction des dépenses qui sont fonction de la distance de plantation (semis, plantation, écimage, traitement Off-Shoot, récolte, transport, mise à la pente, dépente, triage, manocage, mise en halle et amortissement du séchoir).

Avec Ky 35, on voit diminuer les bénéfices lorsqu'on augmente la densité de plantation ; avec PR 8 et SOTA les plus forts bénéfices sont obtenus à 100 x 50, avec les PR 10 à 70 x 35, avec les BB à 100 x 35, avec le Burley 21 à 100 x 40 ; quant au Burley M.B., il dépasse en bénéfice tous les autres à la distance de plantation de 80 x 40. Les var. Burley 49 et Ky 12 ont donné les bénéfices les plus bas du fait de leur sensibilité à *Peronospora*. Les plus hautes primes de qualité accordées au tabac séché ont été : 20,15 % à 80 x 40 pour Ky 35 ; 22,75 % à 100 x 50 pour PR 8 ; 24,2 % à 100 x 50 pour PR10 ; 24,05 % à 80 x 40 pour Burley M.B. ; 21,65 % pour SOTA ; 27,03 % à 80 x 35 pour BB ; 24 % à 80 x 35 pour Burley 21 ; 23,4 % à 100 x 50 pour Burley 49, et 23,65 % à 100 x 50 pour Ky 12. Si l'on rapporte maintenant ces données au tabac fermenté (en Espagne le burley se fermente), on a en général une augmentation des primes, qui dépasse 94,87 % à 100 x 40 pour Ky 35 ; 73, 71 % à 100 x 40 pour PR 10 ; 90,09 % à 100 x 35 pour Burley M.B. ; 70,27 % à 100 x 50 pour BB ; 84,29 % à 100 x 35 pour Burley 49 ; et 50,96 % à 80 x 35 pour Ky 12.

A307 JAMES R.W.

(En anglais) Effets de l'espacement des plantes et de la maturité des feuilles au moment de la cueillette sur trois variétés de tabac flue-cured.

Tob. Res. Station, Motueka, New Zealand.

Les résultats de travaux expérimentaux sur le tabac flue-cured sont traditionnellement rapportés, en augmentations ou diminutions substantielles de rendement, en index de qualité, index de récolte, alcaloïdes totaux, nicotine, sucres totaux, pouvoir de remplissage, teneur en

Using the results from three years experiments with three varieties grown under New Zealand conditions the author attempts to show that a detailed examination of treatment effects in terms of changes in grade composition are much more important than has previously been recognized.
The effects of simple changes in management techniques, such as altering plant spacing and differences in the ripeness of the leaf at the time of harvest are shown to be of importance in both yield of leaf in plant positions and in quality over all leaf positions.
Present criteria used in classifying and selling tobacco determine the grower's profit ; tobacco scientists must ensure that the information derived from experiments will enable producers to maximize their returns by meeting market demand. To achieve this end the grower requires precise information on the effects of management practices : for example the yield of Hicks is very little affected by delays in harvesting but poor quality leaf grades are at a minimum when Hicks is harvested under-ripe ; a rapid increase in poor quality leaf grades takes place if harvesting is delayed until the leaf is ripe ; a further delay to over-ripeness does not result in any further increase in this low value leaf.
Significant differences in yield and grade indices alone can be misleading if the leaf position and quality components of that yield are ignored.

A308 DE BAETS A.

(In French) Influence of some agricultural practices on nicotine and condensate content of tobacco leaf.

Fac. Sci. Agron., Centre Rech. Tab., Gent, Belgique.

During the years 1972 and 1973 experiments were carried out in order to study the influence of some agricultural practices on the alkaloid content and condensate potentiall of tobacco, *Nicotiana tabacum* L., dark air-cured type, cultivar P.B. 91-1.

eau, humidité d'équilibre, etc.
Utilisant les résultats d'expériences de trois années sur trois variétés cultivées dans les conditions de la Nouvelle-Zélande, l'auteur s'efforce de montrer qu'un examen détaillé des effets des traitements en termes de modification de la composition de la qualité est bien plus important qu'on ne l'a admis jusqu'ici.
Les effets de simples modifications dans les techniques de gestion, telles que le changement de l'espacement des plantes et les différences de maturité des feuilles lors de la cueillette, jouent un rôle important dans le rendement de tabac aux différents étages et dans la qualité de tous les étages foliaires.
Les critères actuels qui sont utilisés pour la classification et la vente du tabac déterminent le bénéfice du planteur. Les chercheurs du tabac doivent s'assurer que les informations provenant des expériences permettent aux producteurs de maximiser leurs recettes en répondant à la demande du marché. Pour atteindre ce but, le planteur a besoin d'informations précises sur les effets des pratiques de la gestion. Par exemple, le rendement du Hicks n'est que légèrement affecté par le retard de la cueillette mais les qualités des tabacs inférieures sont minimales lorsque Hicks est cueilli avant sa maturité. Une amélioration rapide des qualités inférieures de tabac se produit si la récolte est retardée jusqu'à ce que la feuille soit mûre. Un retard supérieur, jusqu'à maturité excessive de la feuille, ne se traduit pas par une augmentation plus grande de ce tabac de faible valeur.
Des différences sensibles dans la production et les indices de qualité considérés isolément peuvent conduire à des conclusions erronées si la position de la feuille et les composants de qualité de cette récolte sont ignorés.

A308 DE BAETS A.

Influence de quelques techniques agricoles sur la teneur en nicotine et le potentiel en condensat du tabac en feuille.

Fac. Sci. Agron., Centre Rech. Tab., Gent, Belgique.

Dans les années 1972 et 1973 des essais furent entrepris dans le but de déterminer l'influence de quelques techniques agricoles sur la teneur en nicotine et le potentiel en condensat du tabac, *Nicotiana tabacum* L, type foncé, aircured, cultivar P.B. 91-1.

Normal values of these components are under normal growing conditions (30,000 plants/ha, 200 kg of N/ha, topping and leaf harvesting) :

	lower leaves or lugs	middle leaves cutters	wrappers	tips
% nicotine in the leaf	0.6-1.0	0.7-1.1	1.6-3.0	2.6-3.3
% nicotine in the smoke	0.4-0.8	0.5-0.9	1.4-2.6	1.8-3.0
condensate potential in the smoke	8-11	9-12	13-18	16-23

Changing the number of plants per ha (25,000, 30,000, 35,000 or 40,000) or changing the rate of nitrogen fertilization (100, 150 or 200 kg/ha) did not significantly influence these components.

Non-topping induced a decrease of the nicotine content in the wrappers and tips of 50 %. The condensate content is only decreased by 10 to 20 %.

Topping on a higher number of leaves per plant has the same influence, but the differences are not so big.

Stalk-cutting compared to priming gives a higher nicotine content. Curing under dark plastic sheets increases the influence on the nicotine content, but decreases the condensate potential of the leaf.

A309 YOSHIDA D.

Effects of cultural practices of tobacco on the contents of tar in the smoke.

Central Res. Inst., JTS, Japan.

Among the cultivars of tobacco in Japan, domestic and Burley tobacco, both of which are air-cured types, delivered less tar in the smoke than flue-cured tobacco. The content of tar in the smoke of flue-cured tobacco decreased with no topping and with increased rate of nitrogen fertilization, but increased gradually with the degree of leaf maturity.

Les valeurs normales sont dans les conditions de culture normale (30 000 plantes/ha, 200 unitées d'azote/ha, écimage, récolte en feuilles):

	feuilles basses	feuilles inféri-eures	médianes supéri-eures	feuilles hautes
% nicotine dans la feuille	0,6-1,0	0,7-1,1	1,6-3,0	2,6-3,3
% nicotine dans la fumée	0,4-0,8	0,5-0,9	1,4-2,6	1,8-3,0
% potentiel en condensat dans le fumée	8-11	9-12	13-18	16-23

Un changement de la compacité de plantation (25 000, 30 000, 35 000 ou 40 000 plantes/ha), ou un changement de la fumure azotée (100, 150 ou 200 unités d'azote/ha) n'influencent pas d'une manière significative ces composants.

L'effet du non-écimage est très nette dans les feuilles médianes-supérieures et hautes. La diminution de la teneur en nicotine dans la feuille et dans la fumée dépasse 50 %. L'influence sur le rendement potentiel en condensat est moins grande.

Aussi l'écimage d'un plus grand nombre de feuilles a ce même effet, bien qu'il soit moins prononcé.

Après récolte en tiges, des valeurs supérieures sont trouvées pour la nicotine, et cet effet est encore stimulé par le séchage sous plastique noir.

Le séchage sous plastique noir donne une légère diminution du rendement potentiel en condensat.

A309 YOSHIDA D.

(En anglais) Effets des pratiques culturales sur la teneur en goudron dans la fumée de tabac.

Central Res. Inst., JTS, Japan.

Parmi les espèces de tabac cultivées au Japon, les tabacs domestique et burley, étant tous deux des tabacs de type air-cured, ont présenté moins de goudron dans leur fumée que les tabacs flue-cured. Les teneurs en goudron dans la fumée de tabac flue-cured ont diminué en ne procédant pas à l'écimage et en augmentant le taux de fertilisation azotée, tandis qu'elles aug-

These facts may indicate that tar in the smoke is clearly correlated to leaf maturity in general, since domestic and Burley tobacco are usually harvested at a physiologically younger stage than flue-cured tobacco. The process of maturity is retarded by no topping as well as by increasing the rate of nitrogen fertilization. Flue-cured tobacco, *i.e.* Bright Yellow or Hicks, and air-cured tobacco, *i.e.* Matsukawa or Shiroensyu, were flue- and air-cured respectively. The results showed the curing method to be unrelated to the tar content of the smoke. Lower delivery of tar from air-cured cultivars would not be due to the curing method, but to the delayed process of maturity as mentioned above.

The contents of tar in the smoke of these samples showed no correlation with the physical properties of leaves, such as weight of unit leaf area, bulkiness by compression and pore content of leaf, but did show a significant correlation with the content of alcohol-benzene extractable components in the leaves. The amount of alcohol-benzene extractable components in the leaves increased with the degree of leaf maturity.

A310 SYMEONIDIS G., SFICAS A.G.

Evaluating the adaptability of neutral Oriental tobacco varieties in Greece.

Tobacco Institute, Drama, Greece.

The Finley-Wilkinson statistical technique for variety adaptability evaluation was applied to neutral (filler) Oriental type tobacco in 1973. Five genetically divergent tobacco varieties were tested under four environments. After a $\log_{10}$ data transformation, variety regression lines on mean location yields and first quality percentages were computed. Variety KKP 2/a showed general yield adaptability ($b = 0.97$, *i.e.* close to 1.0) and yielded above average, but its quality percentage was below average. Specific adaptability to favorable environments was shown by varieties Trap. 135XAmar (3) ($b = 1.38$) and KKP-S_2 ($b = 1.39$) and to unfavorable environments by KK

mentaient progressivement au fur et à mesure que le degré de maturité de la feuille s'avançait. Ces faits peuvent indiquer que le goudron dans la fumée est clairement en corrélation avec la maturité de la feuille, étant donné que les variétés de tabac domestique et burley sont généralement récoltées à un stade physiologiquement plus jeune que les tabacs flue-cured. Le processus de maturation est retardé en ne procédant pas à l'écimage, ainsi qu'en augmentant le taux de fertilisation azotée.

Des tabacs flue-cured, i.e. Bright Yellow ou Hicks, et des tabacs air-cured, i.e. Matsukawa ou Shiroensyu ont été respectivement séchés à l'air chaud et séchés à l'air naturel. Les résultats ont montré que la méthode de séchage est inefficace en ce qui concerne la teneur en goudron dans la fumée.

La faible fourniture en goudron des espèces air-cured ne serait pas due à la méthode de séchage, mais plutôt au processus de retardement de la maturation, mentionné ci-dessus.

Les teneurs en goudron dans la fumée de ces échantillons n'ont presenté aucune corrélation avec les propriétés physiques des feuilles, telles que le poids par unité de surface foliaire, le foisonnement sous compression ou la densité de pores des feuilles, mais elles ont présenté une corrélation significative avec la teneur en composants alcool benzène. La quantité de composants extractibles à l'alcool benzène dans les feuilles augmente avec le degré de maturité des feuilles.

A310 SYMEONIDIS G., SFICAS A.G.

(En anglais) Evaluation de l'adaptabilité des variétés de tabac d'Orient neutre en Grèce.

Tobacco Institute, Drama, Greece.

La technique statistique de Finley-Wilkinson a été appliquée pour évaluer l'adaptabilité des variétés grecques de tabac d'Orient neutre (de remplissage) en 1973. Cinq variétés de tabac génétiquement différentes ont été essayées en quatre localités (environnements). Après transformation des données experimentales en $\log_{10}$, les lignes de régression des variétés sur les valeurs moyennes des localités ont été calculées pour le rendement et le pourcentage de première qualité. La variété KKP 2/a a montré une adaptabilité générale ($b = 0,97$ c. à. d. près de 1,0) avec rendement au dessus et pourcentage de première qualité au dessous de la valeur moyenne pour l'ensemble des variétés.